HEATH
MODEL HD-1982 SERIES NO. 01635

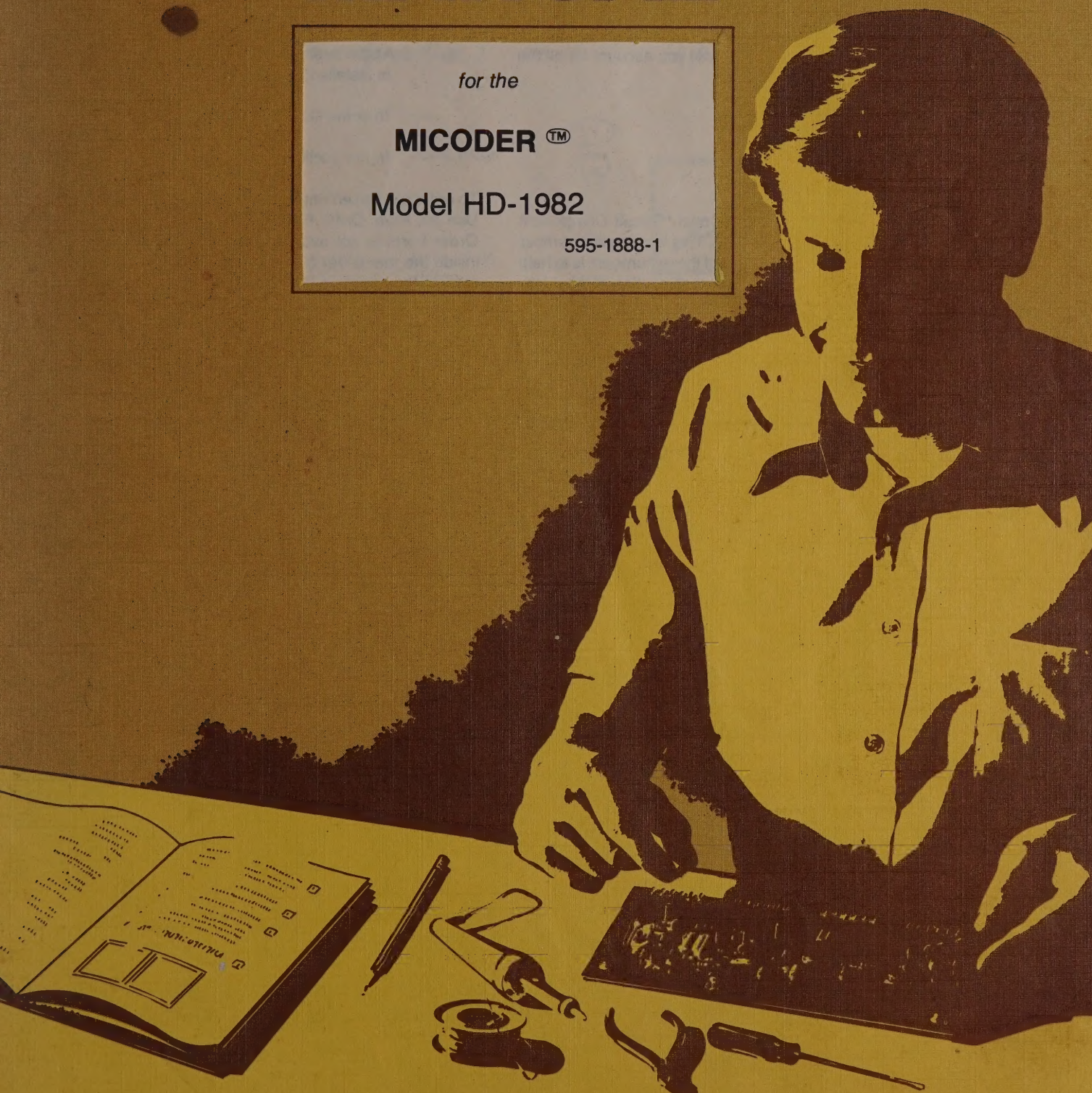
HEATHKIT® MANUAL

for the

MICODER ™

Model HD-1982

595-1888-1



HEATH COMPANY • BENTON HARBOR, MICHIGAN

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The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information ..... (616) 982-3411
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During your first ninety (90) days of ownership, Heath Company will replace or repair free of charge — as soon as practical — any parts which are defective, either in materials or workmanship. You can obtain parts directly from Heath Company by writing us or telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

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If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period, through no fault of yours, we will service it free upon delivery at your expense to the Heath factory, Benton Harbor, Michigan, or to any Heathkit Electronic Center (units of Schlumberger Products Corporation), or through any of our authorized overseas distributors.

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Our warranty, both expressed and implied, does not cover damage caused by use of corrosive solder, defective tools, incorrect assembly, misuse, fire, customer-made modifications, flood or acts of God, nor does it include reimbursement for customer assembly or setup time. The warranty covers only Heath products and is not extended to non-Heath allied equipment or components used in conjunction with our products or uses of our products for purposes other than as advertised.

And if you are dissatisfied with our service — warranty or otherwise — or our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan, 49022. He'll make certain your problems receive immediate, personal attention.

HEATH COMPANY
BENTON HARBOR, MI. 49022

Prices and specifications subject to change without notice.

Price $2.00

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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers in the Parts Pictorial. Any part that is packed in an individual envelope should be returned to the envelope after it has been identified. Keep these parts in the envelopes until they are called for in the assembly step. Do not throw away any packing material until you account for all the parts.

Each circuit part in this kit has its own "Circuit Component Number" (R102, C104, IC103, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of this Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the Parts List;
- At the beginning of each step where a component is installed;
- In some illustrations;
- In the sections at the rear of this Manual.

To order a replacement part, always include the Part Number. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For pricing information, refer to the separate "Heath Parts Price List."

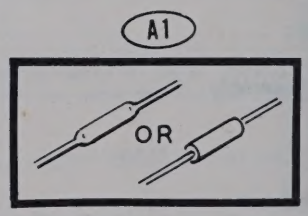
KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

RESISTORS

1/8-Watt

NOTE: The following resistors have a 1% tolerance. The resistors have a temperature coefficient (TC) of 100 parts per million per °C(100 PPM/°C).

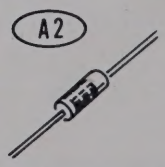
A1	2-51-11	1	3400 Ω (3.4k)	R106
A1	2-39-11	1	3900 Ω (3.9k)	R107
A1	2-50-11	1	5370 Ω (5.37k)	R102
A1	2-17-11	1	5760 Ω (5.76k)	R101
A1	2-49-11	1	6110 Ω (6.11k)	R103
A1	2-48-11	1	6530 Ω (6.53k)	R104
A1	2-26-11	1	8900 Ω (8.9k)	R111
A1	2-40-11	1	10.1 kΩ	R105
A1	2-14-11	1	17.8 kΩ	R108



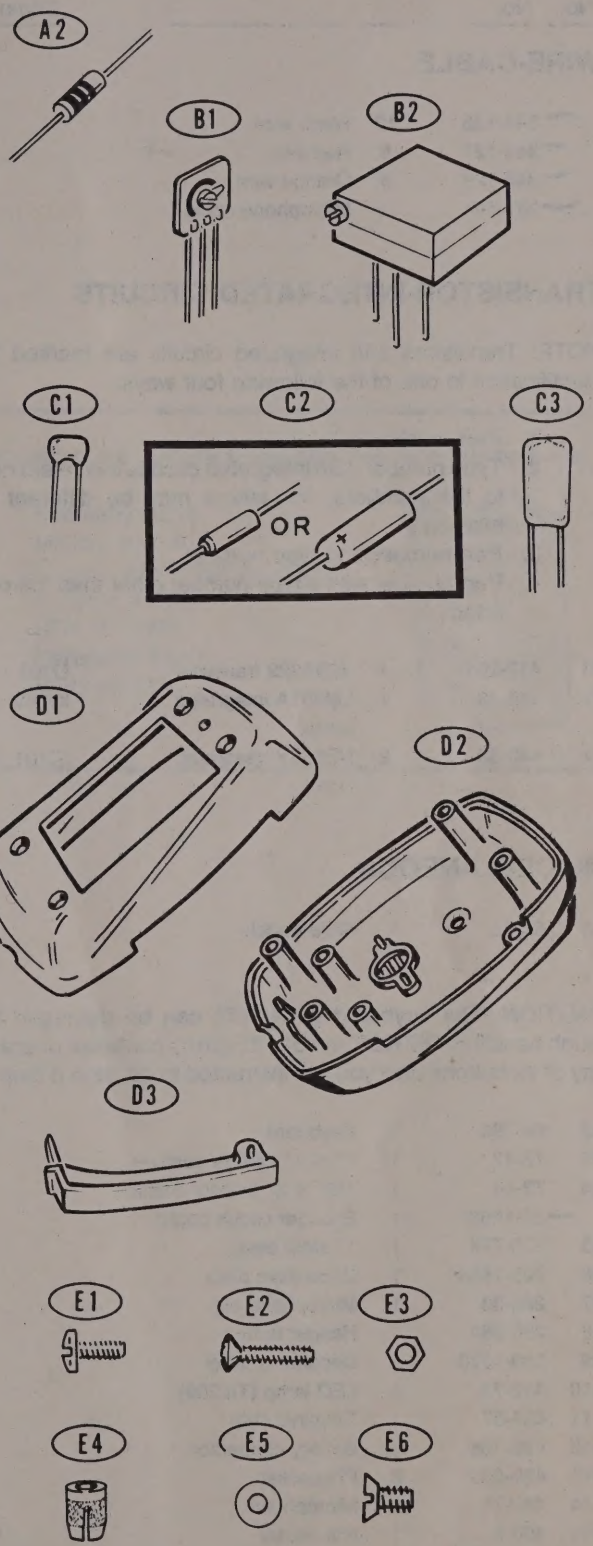
1/4-Watt

NOTE: The following resistors have a 10% tolerance. This is indicated by a fourth color band of silver.

A2	1-1-12	2	100 Ω (brown-black-brown)	R113, R114
A2	1-4-12	1	2200 Ω (red-red-red)	R124
A2	1-6-12	1	3300 Ω (orange-orange-red)	R119
A2	1-9-12	2	10 kΩ (brown-black-orange)	R115, Test
A2	1-45-12	1	22 kΩ (red-red-orange)	R123
A2	1-76-12	1	4700 Ω (YEL-VIOLET-RED)	R-120



KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
1/4-Watt (cont'd.)				
A2	1-32-12	1	100 kΩ (brown-black-yellow)	R117
A2	1-15-12	1 2	330 kΩ (orange-orange-yellow)	~~R116~~, R118
A2	1-19-12	1	1 MΩ (brown-black-green)	R121
A2	1-16-12	1	180 KΩ (BRAUN/GRAY/YEL)	
CONTROLS				
B1	10-1039	1	10 kΩ	R122
B2	10-1065	2	10 kΩ, 25 turns	R109, R112
CAPACITORS				
C1	21-182	3	.047 μF (473) ceramic	C105, C106, C109
~~C2~~	~~25-209~~	~~1~~	~~.047 μF tantalum~~	~~C114~~
C2	25-210	3	.22 μF tantalum	C107, C108, C113
C2	25-161	2	18 μF tantalum	C103, C104
C3	27-74	1	.01 μF Mylar* ?	C111
C3	27-136	1	.015 μF Mylar	C112
C3	27-138	2	.033 μF Mylar	C101, C102
MOLDED PARTS				
D1	95-620	1	Case top	
D2	95-621	1	Case bottom	
D3	95-622	1	PTT switch actuator	
HARDWARE				
#4 Hardware				
E1	250-52	2	4-40 × 1/4" screw	
E2	250-1233	4	4-40 × 7/16" oval head screw	
E3	252-15	4	4-40 hex nut	
E4	252-192	6	4-40 self-retaining nut	
Other Hardware				
E5	253-94	4	#3 flat washer	
E6	250-416	1	6-32 × 1/4" flat head screw	



*Registered Trademark, DuPont

KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

WIRE-CABLE

	344-125	12"	Black wire
	344-127	6"	Red wire
	344-128	6"	Orange wire
	347-59	1	Microphone cable

TRANSISTOR-INTEGRATED CIRCUITS

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

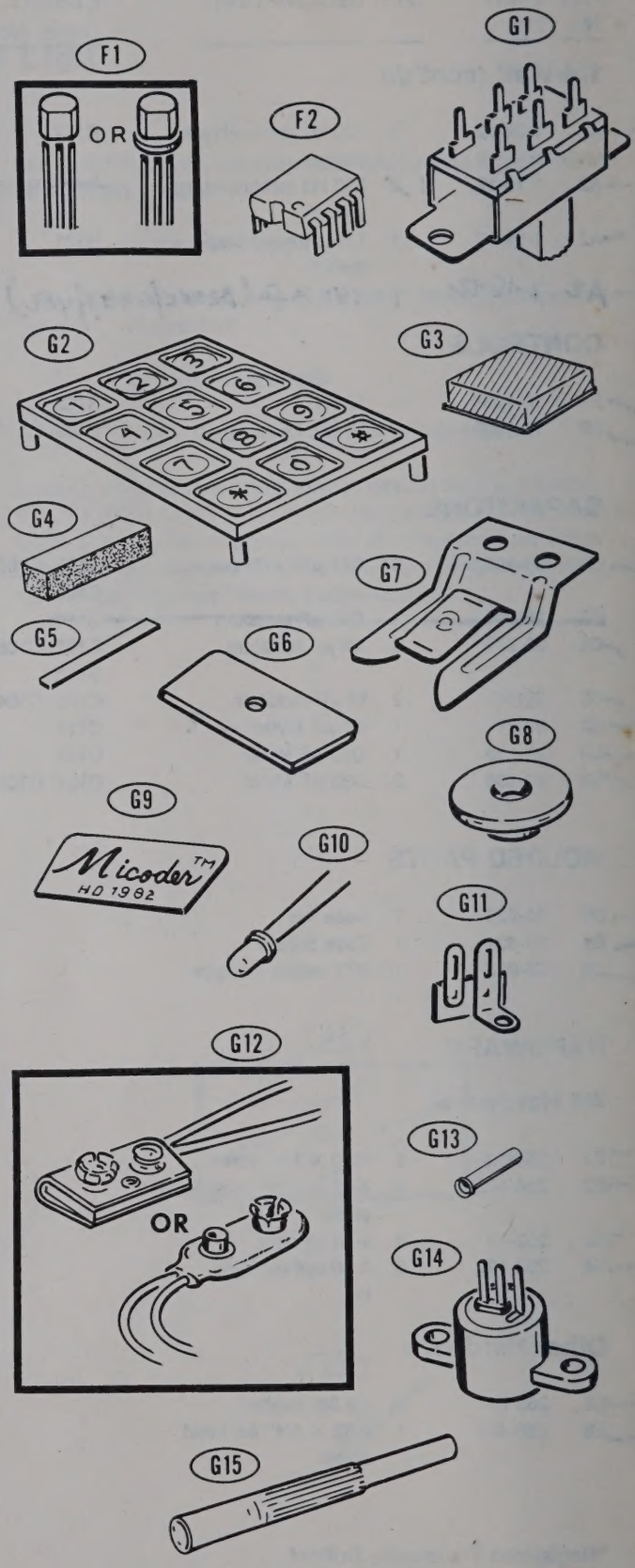
F1	417-201	1	X29A829 transistor	Q101
F2	442-39	1	LM301A integrated circuit	IC103
F2	442-53	2	NE555V integrated circuit	IC101, IC102

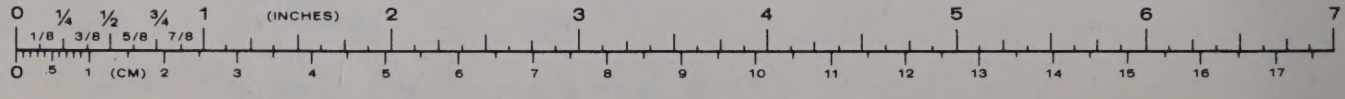
MISCELLANEOUS

G1	60-72	1	Slide switch

CAUTION: The keyboard (#64-780) can be damaged by rough handling. **DO NOT** remove it from its container or press any of its buttons until you are instructed to do so in a step.

G2	64-780	1	Keyboard
G3	73-47	1	1" × 1" battery cushion
G4	73-64	1	1/2" × 2" battery cushion
	85-1668-1	1	Encoder circuit board
G5	205-778	1	1" steel blade
G6	205-1664	1	Decorative plate
G7	260-33	1	Microphone clip
G8	266-884	1	Hanger button
G9	390-1273	1	Decorative label
G10	412-79	1	LED lamp (TIL209)
G11	431-57	1	Terminal strip
G12	432-798	1	Battery connector
G13	432-932	8	Pin socket
G14	480-71	1	Microphone
G15	490-5	1	Nut starter
			Solder





KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

PRINTED MATERIAL

391-34	1	Blue and white label
597-260	1	Parts Order Form
597-308	1	Kit Builders Guide
	1	Assembly Manual (See front cover for part number.)

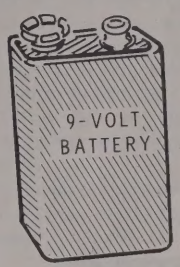
BATTERY

You should purchase the following battery at this time for use in your kit:

One 9-volt transistor battery, NEDA #1604.

Representative manufacturers and their type numbers are:

Eveready #216
Mallory #M1604
Mallory #TR-146X (long life)
Burgess #2V6
RCA #VS323
Hellesens #410
Varta #438



ASSEMBLY NOTES

Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."

When you perform the steps in the circuit board Pictorials, position each part as shown. Follow the instructions carefully and read the entire step before you perform each operation.

Due to the small area around some of the circuit board holes, and the small area between the foils, be very careful to prevent solder bridges between adjacent foils. Use a minimum amount of solder and a 15-25 watt soldering iron with a small (1/8") tip. Allow the iron to reach operating temperature; then apply it only long enough to make a good solder connection.

All the resistors will be identified by the resistance value in ohms (Ω), kilohms (kΩ) or megohms (MΩ). The 1/4-watt resistors have a 10% tolerance and will be identified by the color code. The 1/8-watt precision resistors, however, will have the value stamped on the resistor body.

Capacitors will be identified by the capacitance value (in μF) and type (ceramic, Mylar, and tantalum).

STEP-BY-STEP ASSEMBLY

START

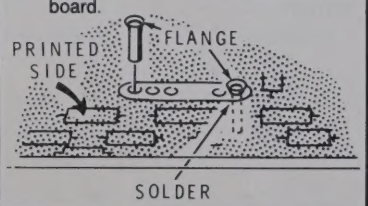
The circuit board has foil on both sides. One side has part outlines printed on it; this side will be called the "**printed side**." The dashed part outlines indicate that these parts will be installed on the other side, called the "**foil side**," of the circuit board. DO **NOT** solder to the printed side of the circuit board unless you are instructed to do so.

Mount all parts **close** to the circuit board. When you solder a lead to the foil, be careful that you do not bridge solder across to another foil. Also, when you install a part on the circuit board, make sure that you do not cover up an unused hole where another part will be installed later.

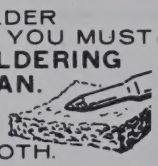
Solder the leads to the foil as you install each part and cut off the excess lead lengths.

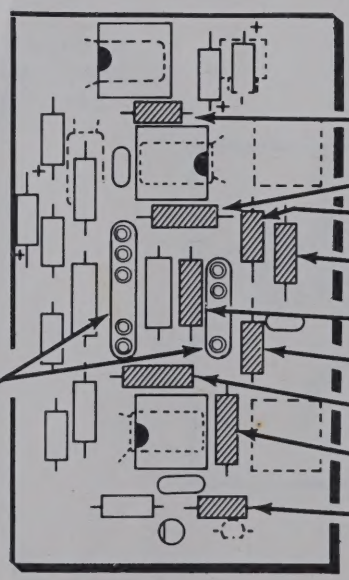
( ) Position the circuit board as shown with the printed side up.

( ) Install eight pin sockets (#432-932). Push each socket through the circuit board hole from the printed side. Then solder the socket to the other side of the circuit board. DO **NOT** cut these sockets off on the foil side of the circuit board.



FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.** WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.





PICTORIAL 1-1

CONTINUE

SAFETY WARNING: Avoid eye injury when you cut off the excess lead lengths. Hold the leads so they cannot fly toward your eyes.

( ) R121: 1 MΩ (brown-black-green).

( ) R105: 10.1 kΩ, 1%, precision.

( ) R114: 100 Ω (brown-black-brown).

( ) R111: 8900 Ω (8.9k), 1%, precision.

( ) R107: **3900 Ω (3.9k)**, 1%, precision.

( ) R113: 100 Ω (brown-black-brown).

( ) R101: 5760 Ω (5.76k), 1%, precision.

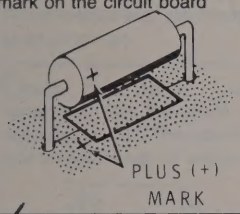
( ) R108: 17.8 kΩ, 1%, precision.

( ) R115: 10 kΩ (brown-black-orange).

see chg.

START

NOTE: When you install tantalum capacitors, always match the plus (+) marked end of the capacitor with the plus (+) mark on the circuit board



(✓) C108: .22 μF tantalum.

(✓) C107: .22 μF tantalum. NOTE: Be sure to use the lower (+) mark.

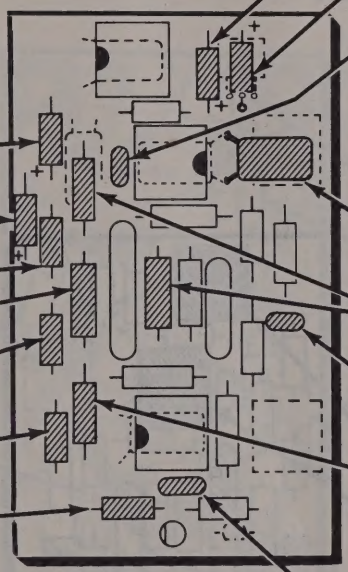
(✓) R117: 100 kΩ (brown-black-yellow).

(✓) R103: 6110 Ω (6.11k), 1%, precision.

(✓) R118: ~~330~~ 180 kΩ (~~orange-orange~~ BR GR-yellow).

(✓) R116: 330 kΩ (orange-orange-yellow).

(✓) R119: 3300 Ω (orange-orange-red).



CONTINUE

(✓) ~~C115: .22 μF tantalum.~~

(✓) C114: .047 μF tantalum. NOTE: Use the lower hole, indicated by the heavy outline.

(✓) C106: .047 μF (473) ceramic.

(✓) Locate a .033 μF Mylar capacitor. Then cut each capacitor lead to 1/4".

NOTE: Install this capacitor as follows: Insert the leads through the circuit board only until they start to protrude from the other side. Then bend the capacitor over against the circuit board and solder the leads to the foil side of the board.

(✓) C102: .033 μF Mylar. NOTE: Disregard the dashed part outline for this capacitor.

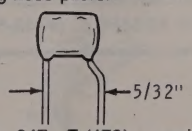
(✓) R102: 5370 Ω (5.37k), 1%, precision.

(✓) R106: 3400 Ω (3.4k), 1%, precision.

(✓) C109: .047 μF (473) ceramic.

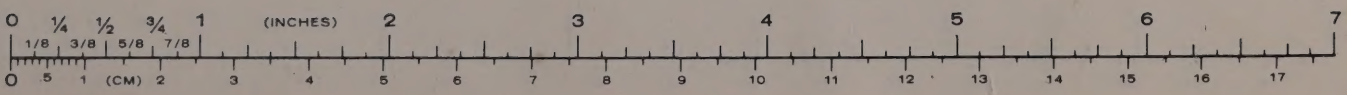
(✓) R104: 6530 Ω (6.53k), 1%, precision.

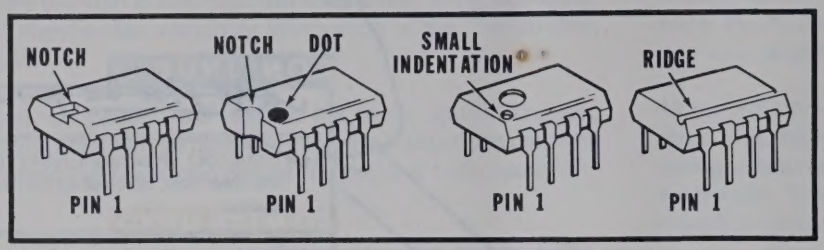
NOTE: Before you install the next capacitor, form its leads as shown using a pair of long-nose pliers.



(✓) C105: .047 μF (473) ceramic.

PICTORIAL 1-2

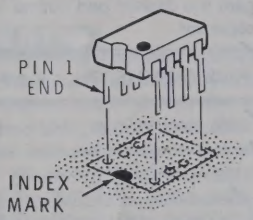




Detail 1-3A

START

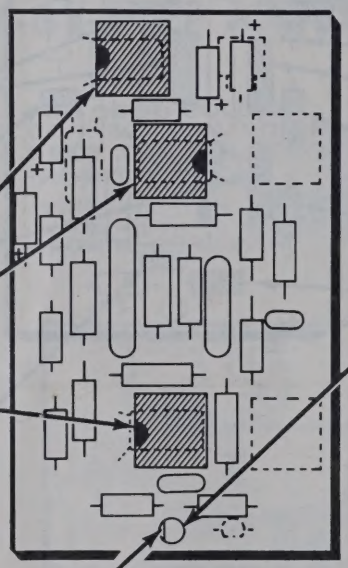
NOTE: In the next three steps, refer to Detail 1-3A and locate the pin 1 end of the IC. Then install the IC with the pin 1 end over the index mark on the circuit board. Make sure that all of the IC pins go through the circuit board.



( ) IC103: LM301A IC (#442-39).

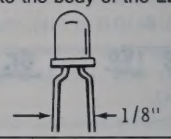
( ) IC102: NE555V IC (#442-53).

( ) IC101: NE555V IC (#442-53).

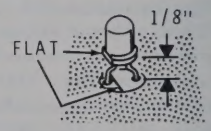


CONTINUE

( ) Before you install the LED (#412-79), form both leads as shown. Use a pair of long-nose pliers to hold each lead close to the body of the LED.



( ) LED 101: Note the flat on one side of the LED. Be sure to position the LED so the flat is over the outline of the flat on the circuit board. Space the LED 1/8" off the circuit board.

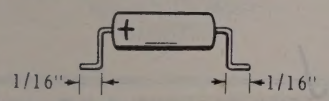


PICTORIAL 1-3

START

( ) Turn the circuit board over and position it as shown. Solder the following parts to the foil side (this side) of the circuit board unless you are instructed to do otherwise.

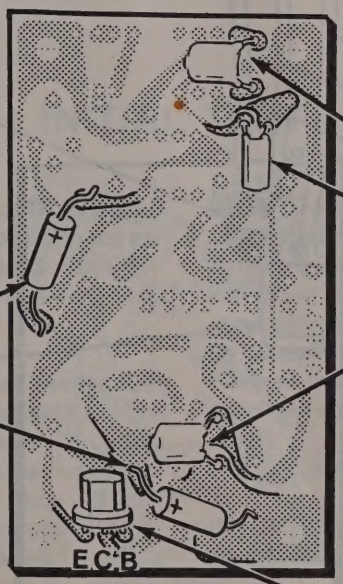
( ) Locate two 18 μF tantalum capacitors. Cut the leads of each capacitor to 1/4". Then bend a 1/16" foot on each lead, as shown.



NOTE: Install the next two capacitors as follows: Position the capacitor with the plus (+) marked end as shown. Then solder the leads directly to the indicated foil pads as there are no empty holes at these locations.

( ) C104: 18 μF tantalum.

( ) C103: 18 μF tantalum.



CONTINUE

( ) Locate one .033 μF, one .015 μF and one .01 μF (.01k) Mylar capacitors. Cut the leads of each capacitor to 1/4".

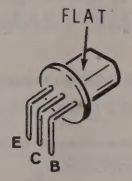
NOTE: Install the next three capacitors as follows: Insert the leads through the circuit board only until they start to protrude from the other side. Then bend the capacitor over against the circuit board and solder the leads to the foil.

( ) C112: .015 μF Mylar.

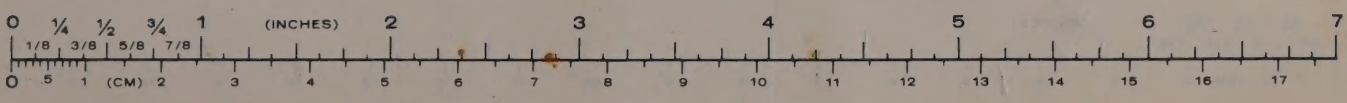
( ) C111: .01 μF (.01k) Mylar.

( ) C101: .033 μF Mylar.

( ) Q101: X29A829 transistor (#417-201). Position the transistor with its flat side up. Then bend the leads down. Insert the transistor leads through the circuit board and solder the leads to the foil. The transistor lead callouts are printed on the other side of the circuit board.



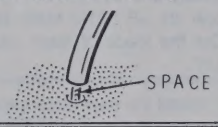
PICTORIAL 1-4



START

NOTES:

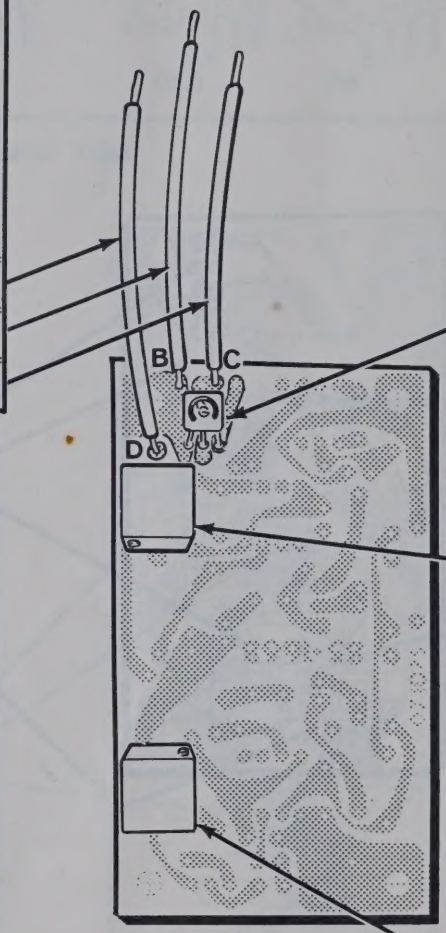
1. Cut the following wires to the proper lengths and remove 1/4" of insulation from each end. Solder each wire as it is connected. Leave a space between the wire's insulation and the foil to allow solder to flow around the wire.
2. Only one end of each wire will be connected at this time.



( ) 3" orange wire to D.

( ) 3" black wire to B.

( ) 2-1/2" red wire to C.

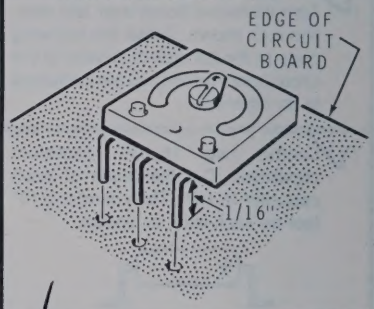


PICTORIAL 1-5

CONTINUE

NOTE: In the following step, bend each lead close to the control body.

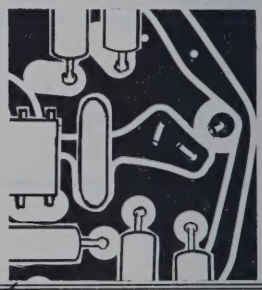
( ) R122: 10 kΩ control. First bend the leads at a right angle to the control. Then cut the leads to 1/16".



( ) Solder the control leads to the circuit board foil.

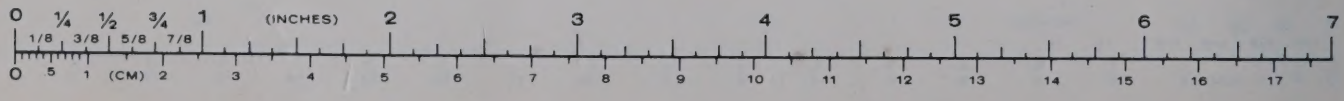
NOTE: In the following step, temporarily lift the .033 μF Mylar capacitor on the printed side of the circuit board.

( ) R112: 10 kΩ, 25-turn control. Insert the leads through the circuit board holes. Cut off all three leads to 1/16" on the printed side of the circuit board. Use a blunt tool to firmly press the cut leads against the foil so they follow the contour of the foil pad, as shown below.



( ) R109: 10 kΩ, 25-turn control. Install this control in the same manner.

w/ sec chg



CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads. NOTE: DO NOT cut the eight pin sockets off on the foil side of the circuit board.

( ) Integrated circuits for the proper **type** and **installation**.

( ) Transistor for the proper **installation**.

( ) Tantalum capacitors for the correct position of the positive (+) end.

( ) LED lamp for the correct position of the "flat side."

The keyboard will be installed later. Proceed to the "Initial Tests."

INITIAL TESTS

The purpose of the "Initial Tests" section of this Manual is to make sure your Micoder operates and will not be damaged as a result of a wiring error. A transistor or integrated circuit, for example, could be destroyed instantly by a short circuit that causes excessive current.

You will need an ohmmeter to make resistance measurements on the circuit board. This test will tell if a short circuit or open circuit exists, which might cause a problem when power is applied to the circuit board. If you cannot obtain the proper ohmmeter reading in the following steps, refer to the "In Case of Difficulty" section. DO NOT apply power to the circuit board until the difficulty has been corrected.

NOTE: Use a vacuum tube voltmeter (VTVM) or a volt-ohmmeter (VOM) to make the resistance checks in the following steps (solid-state ohmmeters do not furnish a voltage high enough to make the diodes conduct in the circuit being tested.) Make sure you have the ohmmeter set correctly, since the range setting influences the meter reading when a diode is in the circuit.

To make this test, first touch the test leads of your ohmmeter together and vary the ZERO ADJUST control to obtain a "0" reading on the meter. If you get this reading in any of the resistance checks that follow, it will mean that there is a short circuit somewhere in the circuit you are checking.

In any of these resistance checks, a meter reading lower in value than the one shown in the chart might indicate a solder bridge across adjacent foils on the circuit board. A meter reading that is higher than the one shown might indicate a poor solder connection or a faulty or improperly installed component.

NOTE: The internal wiring of most ohmmeters is such that the positive terminal of the meter battery is connected to the positive (red) test lead and the negative battery terminal is connected to the negative (black) test lead. In some ohmmeters this wiring is reversed and erroneous readings will be obtained when you make the following measurements. Reverse the ohmmeter leads if the measurements do not check out correctly the first time.

( ) Set your ohmmeter to the RX100 range.

IMPORTANT: The ohmmeter readings in the following chart were made with a Heathkit Model IM-18 VTVM.

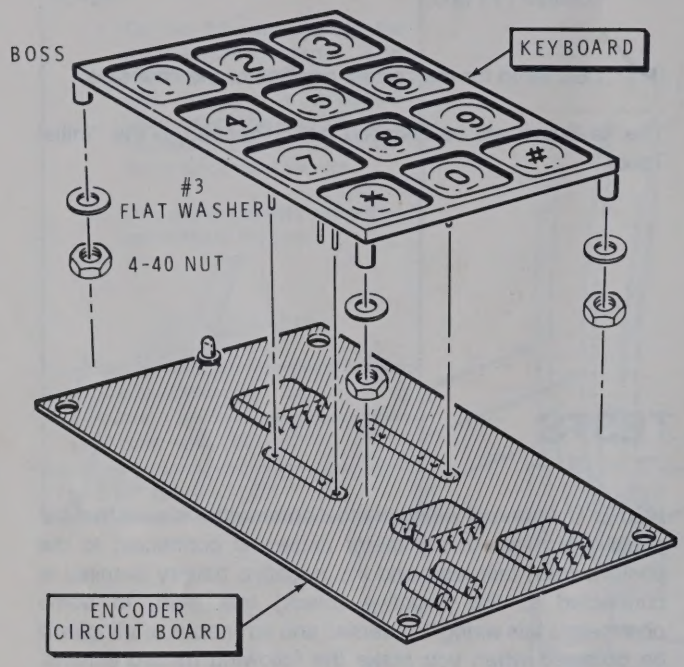
( ) Connect your ohmmeter leads as directed and make the measurements shown on the following chart.

OHMMETER TEST POINTS		RESISTANCE IN OHMS
COMMON LEAD	POSITIVE (+) LEAD	
Black lead	Red lead	INF
Black lead	Orange lead	4-6 kΩ

If you do not obtain the proper ohmmeter readings, look for solder bridges or foil bridges on the circuit board and refer to "In Case of Difficulty" on Page 20.

This completes the tests. Disconnect the meter leads and proceed to "Keyboard Installation."

KEYBOARD INSTALLATION



PICTORIAL 2-1

Refer to Pictorial 2-1 for the following steps.

CAUTION: DO **NOT** push any of the keyboard buttons until you have completed the next three steps.

( ) Remove the keyboard (#64-780) from its container.

( ) Install a #3 flat washer on one of the keyboard bosses. Then, using a pair of long-nose pliers, start a 4-40 nut on this boss to form threads. Carefully tighten the nut. DO **NOT** overtighten as you may strip the threads.

( ) Similarly, install a #3 flat washer and a 4-40 nut on each of the three remaining bosses.

( ) Position the keyboard and encoder circuit board as shown. Then insert the keyboard pins into the proper pin sockets on the circuit board. Be sure the keyboard bosses are pressed tightly down against the circuit board. Carefully inspect the space between the keyboard and the circuit board for any parts which might interfere with the keyboard. For example, if a ceramic capacitor interferes, bend it over.

CASE BOTTOM ASSEMBLY

Refer to Pictorial 2-2 for the following steps.

( ) Install a 4-40 self-retaining nut at B. Position the nut with the slotted end pointing down as shown. Then, using the plastic handle of a screwdriver, carefully press the nut down into the boss until it is flush with the top of the boss.

( ) In the same manner, install a self-retaining nut in each of the remaining five bosses in the case bottom at C, D, E, H, and J.

NOTE: Perform the next step only if the three microphone lugs DO **NOT** line up with the the two small tabs in the rubber mount as shown in the Pictorial.

( ) Carefully push the microphone out of the rubber mount with your fingers. Line up the three microphone lugs with the two small tabs in the rubber mount. Then carefully push the microphone back into the rubber mount.

( ) Install the microphone at F. Make sure lug 3, connected to the metal case, is positioned as shown. Push the small tabs over the studs in the case bottom. Then push the microphone down so it is properly seated in hole F.

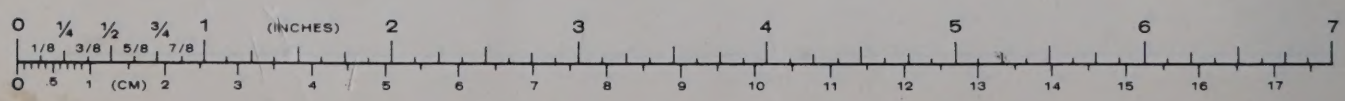
Refer to Detail 2-2A for the next three steps.

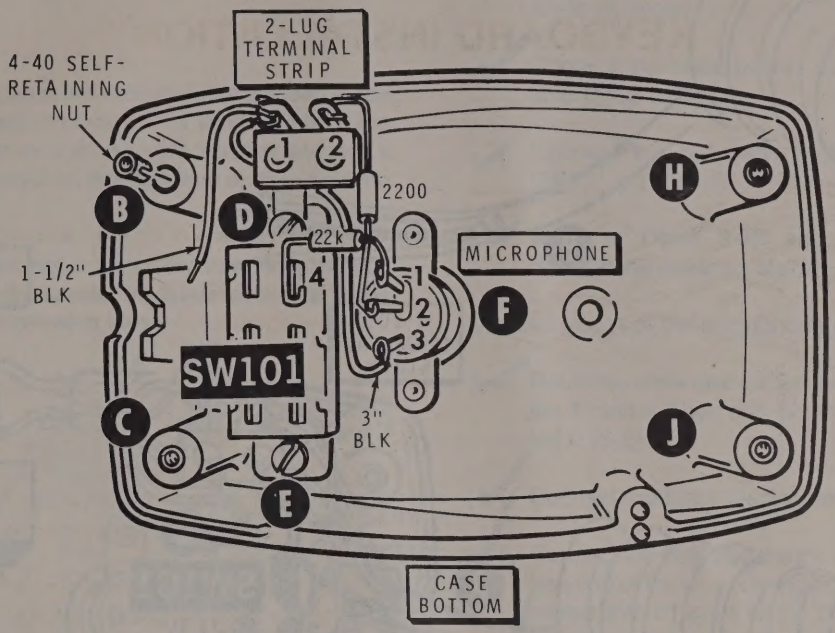
( ) Use diagonal cutters to cut off the narrow portion of each of the six lugs on the PTT switch.

( ) Prepare the 2-lug terminal strip by bending the lugs up as shown.

NOTE: In the following step, make sure you install the PTT switch so the lever is toward boss E.

( ) SW101: Install the prepared PTT switch at SW101. Use a 4-40 × 1/4" screw at E and the prepared 2-lug terminal strip and a 4-40 × 1/4" screw at D.





PICTORIAL 2-2

NOTES:

1. To prepare a wire, as in the next step, cut the wire to the indicated length and remove 1/4" of insulation from each end. Then twist the strands together and melt a small amount of solder on the bare wire ends to hold the strands together.

2. In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.

( ) Prepare the following wires:

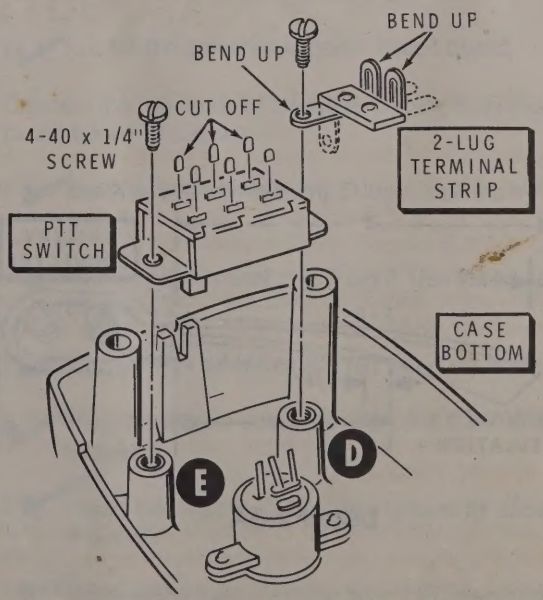
3" black 1-1/2" black

( ) Connect a 3" black wire from the microphone lug 3 (S-1) to terminal strip D lug 1 (NS).

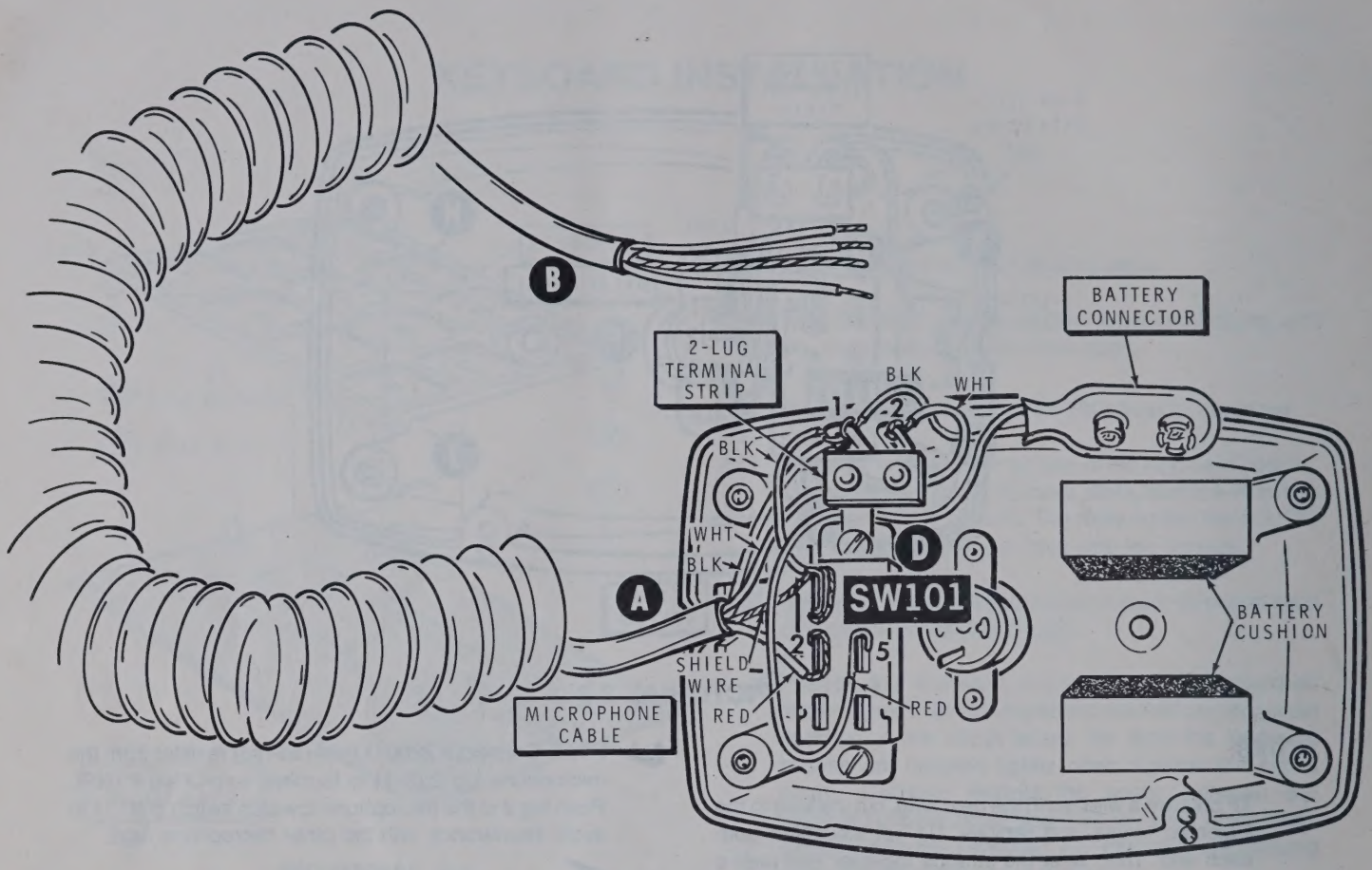
( ) Connect one end of a 1-1/2" black wire to terminal strip D lug 1 (NS). The other end of this wire will be connected later.

( ) R124: Connect a 2200 Ω (red-red-red) resistor from the microphone lug 2 (S-1) to terminal strip D lug 2 (NS). Push lug 2 of the microphone towards switch SW101 to avoid interference with the other microphone lugs.

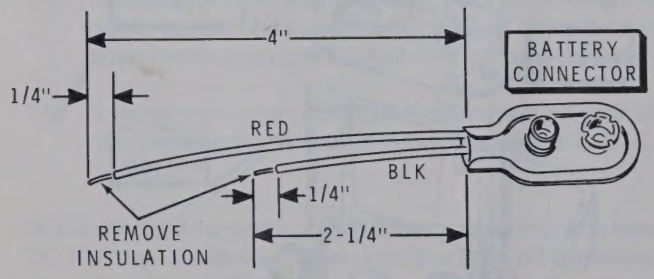
( ) R123: Connect a 22 kΩ (red-red-orange) resistor from the microphone lug 1 (S-1) to switch SW101 lug 4 (NS). NOTE: Make sure the resistor leads do not short to the metal switch case or the other resistor.



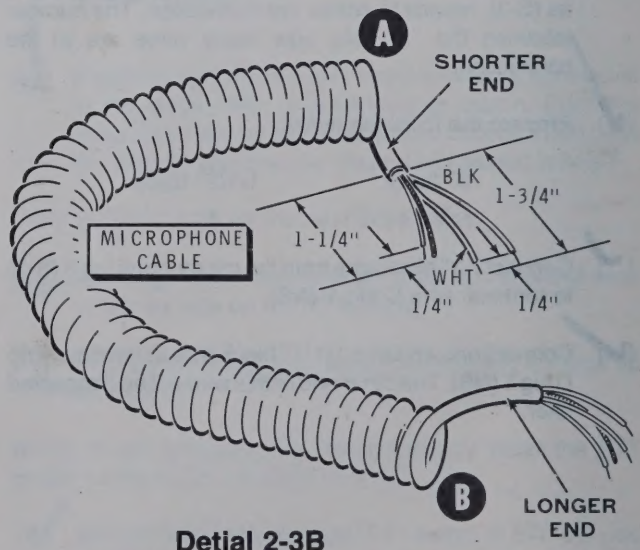
Detail 2-2A



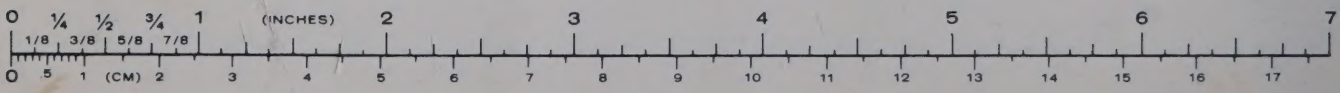
PICTORIAL 2-3



Detail 2-3A



Detial 2-3B

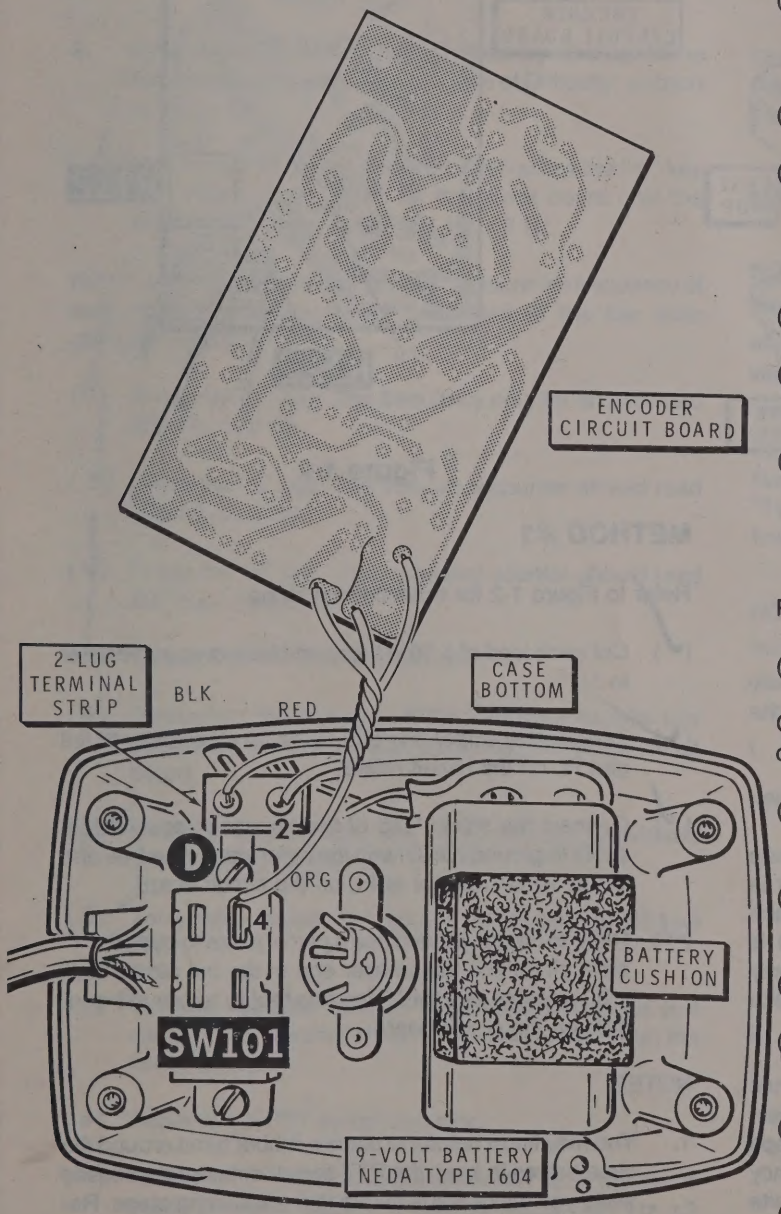


Refer to Pictorial 2-3 for the following steps.

NOTES:

1. To prepare a lead, as in the next step, cut the lead to the indicated length and remove 1/4" of insulation from the indicated end. Then twist the strands together and melt a small amount of solder on the bare wire ends to hold the strands together.

2. Be careful so you do not accidentally burn the insulation on any leads when you solder the leads to the lugs of the PTT switch in the following steps.



PICTORIAL 2-4

(✓) Refer to Detail 2-3A and prepare the battery connector leads as shown.

(✓) Connect the black battery connector lead to terminal strip D lug 1 (NS).

(✓) Connect the red battery connector lead to switch SW101 lug 5 (S-1).

(✓) Refer to Detail 2-3B and prepare end **A** of the microphone cable as shown.

Connect end A of the microphone cable as follows:

(✓) Route the white lead under the terminal strip as shown in the Pictorial. Then connect the lead to terminal strip D lug 2 (S-2).

(✓) Connect the black lead to terminal strip D lug 1 (S-4).

(✓) Connect the shield lead of the microphone cable and the free end of the wire coming from terminal strip D lug 1 to switch SW101 lug 1 (S-2). Twist the ends of the leads together before you solder them to the switch lug.

(✓) Connect the red wire to switch SW101 lug 2 (S-1).

(✓) Cut the 1/2" × 2" battery cushion in half with a pair of scissors.

(✓) Remove the protective paper backing from only one side of one battery cushion, one-half at a time. Then press both halves onto the inside of the case bottom at the location shown.

Refer to Pictorial 2-4 for the following steps.

(✓) Locate the prewired encoder circuit board.

Connect the free ends of the wires coming from the encoder circuit board as follows:

(✓) Black wire to terminal strip D lug 1. Use the eyelet of lug 1 (S-1).

(✓) Red wire to terminal strip D lug 2. Use the eyelet of lug 2 (S-1).

(✓) Orange wire to switch SW101 lug 4 (S-2).

(✓) Plug the battery connector onto the 9-volt battery (not supplied).

(✓) Install the battery in the case bottom as shown in the Pictorial.

(✓) Remove the paper backing from the battery cushion and press it against the battery as shown.

(✓) Twist the three wires coming from the encoder circuit board together by turning the board three full turns.

ADJUSTMENTS

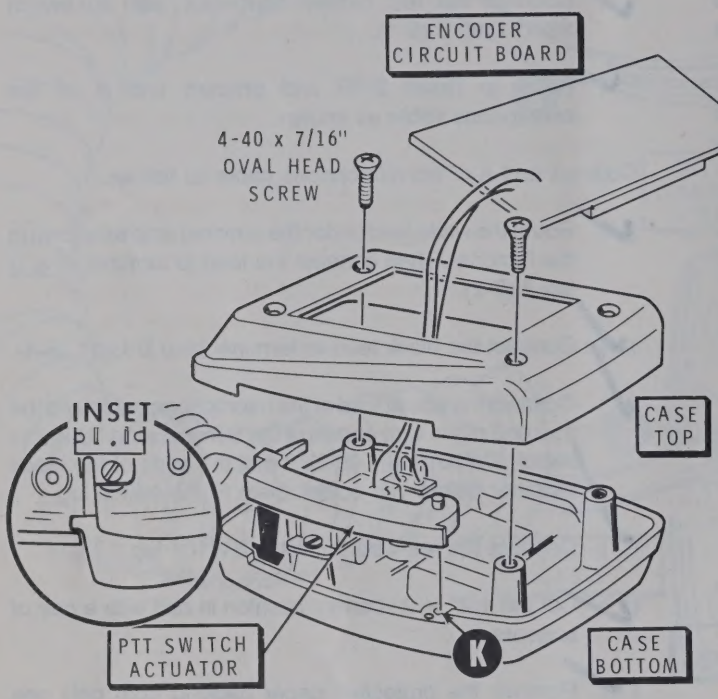


Figure 1-1

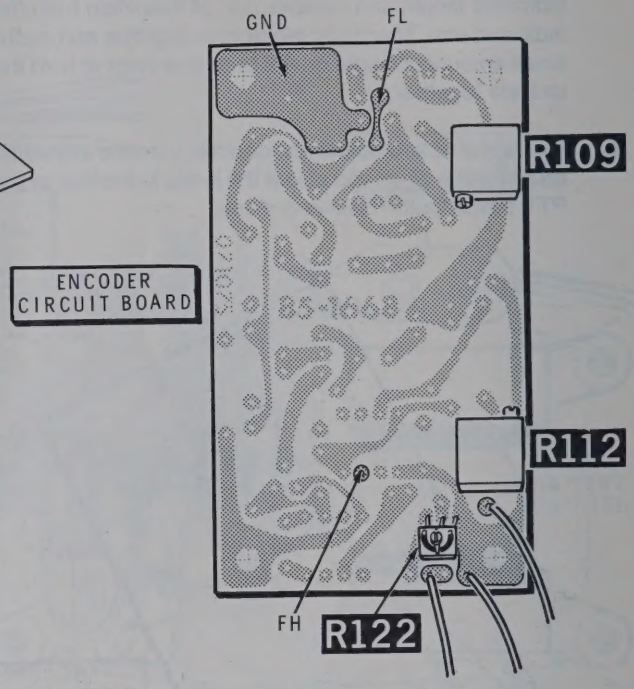


Figure 1-2

Refer to Figure 1-1 for the following steps.

( ) Temporarily push the encoder circuit board through the rectangular hole in the case top as shown.

NOTE: Hole K, referred to in the next step, is the inner hole.

( ) Position the PTT switch actuator so its pivoting pin rests in hole K. Make sure the other end of the actuator is positioned as shown in the inset drawing. Then place the case top over the assembly. Be sure the top is seated properly on the case bottom. Then temporarily install two 4-40 × 7/16" oval head screws in opposite corners as shown. DO **NOT** tighten these screws.

You can use either of two methods to adjust the tones generated by the encoder circuitry to the correct frequencies. If you have access to a frequency counter, perform the steps under Method #1. This is the preferred method. If a frequency counter is not available, and you live near a repeater site where a decoder is available to decode the tone frequencies produced, perform the steps under "Method #2."

METHOD #1

Refer to Figure 1-2 for the following steps.

( ) Cut each lead of a 10 kΩ (brown-black-orange) resistor to 1/2".

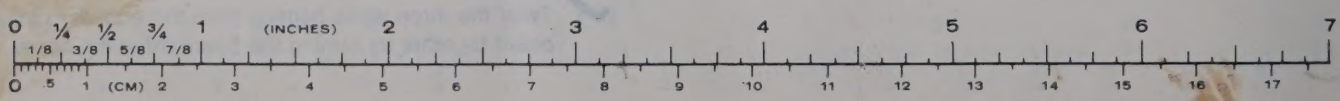
( ) Temporarily solder one end of the 10 kΩ resistor to foil pad FL on the circuit board.

( ) Connect the shield lead of the frequency counter test cable to ground (GND) and the inner lead to the free end of the 10 kΩ resistor at FL on the circuit board.

( ) Refer to Figure 1-3 and use a pair of pliers to push the 1" steel blade into the smaller end of the nut starter until 1/8" remains exposed. Use this tool to adjust the controls on the circuit board.

NOTES:

1. You may find it helpful to place a rubber band around the case halves to keep the PTT switch actuator depressed while you make adjustments in the following steps. Remove the rubber band when you are instructed to release the actuator.



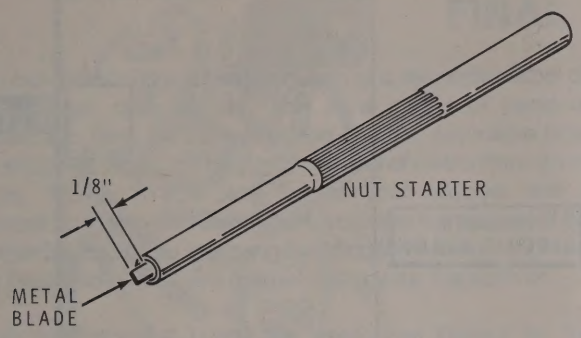


Figure 1-3

2. If you do not obtain the correct frequency readings in the following steps, refer to the "In Case of Difficulty" section on Page 20.

( ) Press the PTT switch actuator. Then press the "#" key and adjust control R109 on the circuit board until the frequency counter reads 941 Hz ±2 Hz.

NOTE: In the following steps you will measure the frequency of each of the remaining tones generated in the low tone oscillator circuit.

( ) Press the "9" key. The frequency counter should read 852 Hz ±13 Hz.

( ) Press the "6" key. The frequency counter should read 770 Hz ±12 Hz.

( ) Press the "3" key. The frequency counter should read 697 Hz ±11 Hz.

( ) Release the PTT switch actuator.

( ) Disconnect the inner lead of the frequency counter test cable from the resistor lead at foil pad FL on the circuit board.

( ) Unsolder and remove the 10 kΩ resistor previously connected to foil pad FL.

( ) Temporarily solder one lead of this resistor to foil pad FH.

( ) Connect the inner lead of the frequency counter test cable to the free end of the 10 kΩ resistor at FH on the circuit board.

( ) Depress the PTT switch actuator.

( ) Press the "#" key and adjust control R112 on the circuit board until your frequency counter reads 1477 Hz ±2 Hz.

NOTE: In the following steps you will measure the frequency of each of the remaining tones generated in the high tone oscillator circuit.

( ) Press the "0" key. The frequency counter should read 1336 Hz ±20 Hz.

( ) Press the "*" key. The frequency counter should read 1209 Hz ±18 Hz.

( ) Release the PTT switch actuator and turn your transceiver off.

( ) Unsolder and discard the 10 kΩ resistor previously connected to foil pad FH.

This completes the adjustments of the tone frequencies. Proceed to "Typical Transceiver Installation" on Page 20. Then continue with "Level Adjustment" on Page 18.

METHOD #2

NOTE: You will need the assistance of somebody familiar with the facilities at your nearby repeater site when you perform the adjustments using this method. These adjustments can conveniently be made at the repeater site (or where the repeater receiver is located).

Refer to Page 20 of this Manual and complete the steps under "Typical Transceiver Installation." Then continue with the following steps.

NOTE: If you added a connector to the free end of the microphone cable, complete the next step. Otherwise, disregard this step.

( ) Plug in the microphone.

NOTES:

1. You may find it helpful to place a rubber band around the case halves to keep the PTT switch actuator depressed while you make adjustments in the following steps. Remove the rubber band when you are instructed to release the actuator.

2. If you do not obtain the correct results in the following steps, refer to the "In Case of Difficulty" section on Page 20.

( ) Refer to Figure 1-3 and use a pair of pliers to push the 1" steel blade into the smaller end of the nut starter until 1/8" remains exposed. Use this tool to adjust the controls on the circuit board.

( ) Using the prepared tool, turn controls R109 and R112 30 turns counterclockwise.

( ) Turn control R122 to midrange.

( ) Set the channel selector of your transceiver to the frequency of the repeater you will be using.

( ) Turn your transceiver on.

( ) Push the "#" sign on the encoder keyboard and, at the same time, depress the Micoder PTT switch actuator.

NOTE: In the following step, you may have to readjust control R122 slightly if the decoder indicator does not turn on.

( ) With the "#" sign pushed and the actuator depressed, turn control R109 slowly in a clockwise direction until the decoder indicator for the low tone frequency (941 Hz) "turns on." Continue to turn this control in the same direction until the indicator "turns off." Count the number of turns between thse two settings. Then adjust control R109 to the center of this range.

( ) In the same manner, adjust control R112 for the high tone frequency (1477 Hz).

NOTE: If the decoder has indicators for the remaining tone frequencies produced by the encoder, two of these indicators will turn on when any of the keyboard buttons is being pushed and the correct frequencies are generated. The chart on the Schematic fold-in shows what frequencies are generated in the encoder.

( ) Refer to the chart on the Schematic fold-in and push each of the remaining keyboard buttons. Make sure the two proper indicators, as shown in the chart, turn on.

( ) Release the Micoder PTT switch actuator.

( ) Turn your transceiver off.

This completes the adjustments of the tone frequencies. Proceed to "Level Adjustment."

LEVEL ADJUSTMENT

The LEVEL control will now be adjusted to insure that the transmitted signal is properly modulated when you are using the Micoder.

Refer to Figure 1-4 for the following step.

( ) If you have not already done so, turn control R122 to midrange.

( ) Turn your transceiver on.

( ) Depress the Micoder PTT switch actuator.

( ) Check to see that the LED lamp, on the encoder circuit board, lights when any of the keyboard signs is pushed.

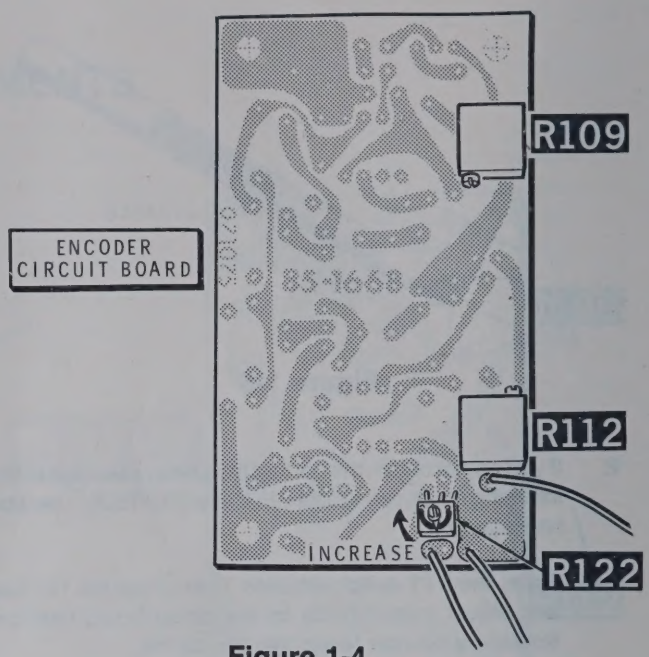


Figure 1-4

Use one of the following methods, listed in the order of accuracy, to adjust the level controls in your transceiver and the Micoder.

1. ( ) While you speak into the Micoder microphone, adjust the transmitter LEVEL control for 4.5 to 5 kHz of FM deviation using a deviation monitor meter. Then, while you key the transmitter, and at the same time push the "#" sign on the encoder keyboard, adjust the Micoder LEVEL control (R122) for 4.3 to 4.8 kHz of FM deviation. NOTE: Increase the deviation by turning control R122 in the direction shown on Figure 1-4.

2. ( ) If a deviation monitor meter is not available, use on-the-air checks with other amateur operators. Check with three or four stations to get a consensus of opinion on the recaptured audio in their receivers. While you speak into the Micoder microphone, adjust the transmitter LEVEL control. Then, while you key the transmitter, and at the same time push the "#" sign on the encoder keyboard, adjust the Micoder LEVEL control (R122), until they say your deviation is correct.

NOTE: You may have to readjust the Micoder LEVEL control slightly to gain access to the auto patch.

( ) Release the Micoder PTT switch actuator and turn your Transceiver off.

( ) Remove the two 4-40 × 7/16" oval head screws previously installed to hold the case top and case bottom together. Lay the screws aside.

This completes the "Adjustments" of your Micoder. Proceed to "Final Assembly."

FINAL ASSEMBLY

You can install either a hanger button or a decorative label on the Micoder case bottom. This is a matter of personal preference. Both the hanger button and the decorative label are supplied. Refer to the appropriate set of instructions given below. NOTE: If you plan to use your Micoder with a transceiver in a mobile installation, you may want to install the hanger button so you can hang the Micoder in the microphone clip (supplied) when you are not using your transceiver.

Refer to Pictorial 3-1 and the associated Details for the following steps.

HANGER BUTTON

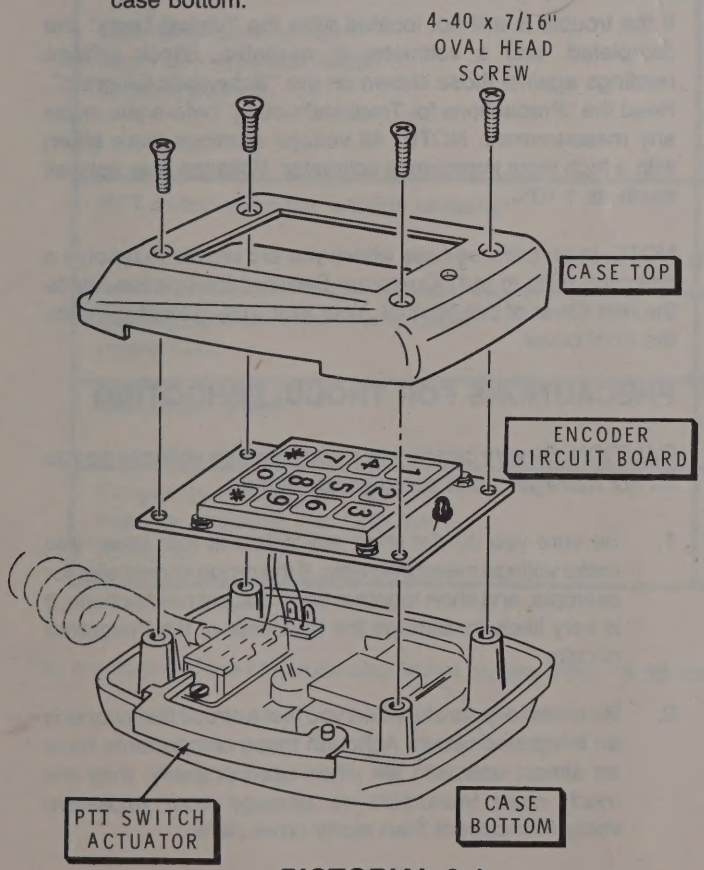
( ) Refer to Detail 3-1A and temporarily position the battery connector with battery as shown.

( ) Mount the hanger button at F with the decorative plate and a 6-32 × 1/4" flat head screw.

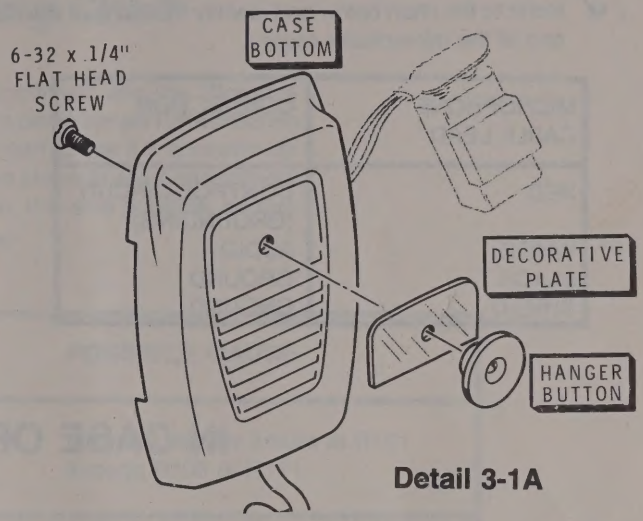
DECORATIVE LABEL

( ) Remove the protective paper backing from the decorative label.

( ) Refer to Detail 3-1B and press the label into place on the case bottom.



PICTORIAL 3-1



Detail 3-1A

Complete the assembly of your Micoder by completing the following steps in the sequence listed.

1. ( ) Push the encoder circuit board down against the bosses in the case bottom. Hold the circuit board in place with one finger.

2. ( ) Position the PTT switch actuator as shown in the Pictorial.

3. ( ) Position the microphone cable so the outer insulation rests in the U-shaped groove in the case bottom.

4. ( ) Place the case top over the encoder circuit board and onto the case bottom.

5. ( ) Secure the case top to the case bottom with four 4-40 × 7/16" oval head screws.

( ) Carefully peel away the paper backing from the blue and white label. Then press the label onto the cover of this Manual.

Detail 3-1B

TYPICAL TRANSCEIVER INSTALLATION

(✓) Refer to the chart below and identify the leads at the free end of the microphone cable.

MICROPHONE CABLE LEAD	CONNECTION
RED	CONTROL CIRCUIT (GROUNDING)
WHITE	AUDIO
BLACK	GROUND
SHIELD	GROUND

(✓) Refer to the proper section in the manual for your transceiver and connect each of the above leads to the proper location.

This completes the "Final Assembly."

IN CASE OF DIFFICULTY

The first part of this section of the Manual titled "Visual Tests," describes what to do about the difficulties that may occur right after your unit is assembled.

If the "Visual Tests" fail to clear up the problems, or if difficulties occur after your unit has been in use for some time, read the following information, then refer to the "Troubleshooting Chart."

VISUAL TESTS

1. About 90% of the kits that are returned to the Heath Company for service do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide."

2. Closely examine each circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, use a magnifying glass for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "Circuit Board X-Ray Views" on Page 25.

3. Check each capacitor value. Be sure that a capacitor of correct value is installed at each capacitor location. Check each tantalum capacitor to be sure the lead near the positive (+) mark is at the correct position.

4. Check each resistor value carefully. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial Diagrams. It would be easy, for example, to install a 100 Ω (brown-black-brown) resistor where a 100 kΩ (brown-black-yellow) resistor should have been installed.

5. Be sure all wires and leads connected to the circuit board have been trimmed as close as possible to the circuit board foils.

6. Try to analyze the symptoms of any problem you may have before starting any troubleshooting procedure. A review of the "Circuit Description" may also help you determine where the trouble is.

If the trouble is still not located after the "Visual Tests" are completed, and a voltmeter is available, check voltage readings against those shown on the "Schematic Diagram". Read the "Precautions for Troubleshooting" before you make any measurement. NOTE: All voltage readings were taken with a high input impedance voltmeter. Voltages may vary as much as ±10%.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

PRECAUTIONS FOR TROUBLESHOOTING

CAUTION: Be very careful when you measure voltages so you do not damage circuit board components.

1. Be sure you do not short any adjacent foils when you make voltage measurements. If the probe should slip, for example, and short together two adjacent connections, it is very likely to damage the transistor or the integrated circuits.

2. Be especially careful when you test a circuit that contains an integrated circuit. Although these components have an almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than many other parts.

Troubleshooting Chart

The following chart lists the "Condition" and the "Possible Cause" of some malfunctions. If a particular part is mentioned as a possible cause, check that part to see if it is incorrectly wired or installed improperly. Also check to see if an improper part was installed at that location. It is also possible, on rare occasions, for a part to be faulty.

CONDITION	POSSIBLE CAUSE
Incorrect tone frequencies are being produced.	1. Incorrect resistor values at R101 through R108 or R111.
*Improper relationship between the amplitudes of the high and the low tones when any keyboard button is being pushed.	1. Incorrect resistor value at R116, R117, or R118. 2. Capacitor C108 not properly soldered to the foil or defective. 3. Capacitor C107 incorrect value or defective.
LED lamp does not light when any keyboard button is being pushed.	1. Transistor Q101 incorrectly installed or defective. 2. LED 101 is installed incorrectly or defective. 3. Low battery voltage.
PTT switch does not function properly.	1. Wiring of the microphone circuit in your transceiver. 2. Wiring of the microphone cable.
No microphone output, but encoder output O.K.	1. Wiring of the microphone element.
Short battery life.	1. Wiring shorted to the metal frame of the PTT switch.
Frequency of tone generated by encoder unstable. The LED may not light.	1. Low battery voltage.

*The amplitude of the high tone should not be less than −8 dB lower than the low tone and not more than +4 dB higher.

SPECIFICATIONS

Operating Voltage	9.0 VDC.
Current Consumption	12 mA.
Battery Life	Approximately 6 months.
Output Level	30 mV rms maximum.
Output Load	10 kΩ minimum.
Frequency Tolerance	±1.5%.
Operating Temperature Range*	−20° to + 110°F. (−29° to +43°C).
Total Distortion (from encoder)	<5% (harmonic plus intermodulation).
Dimensions	3-3/4" high × 2-5/8" wide × 1-3/4" deep (9.5 × 6.7 × 4.4 cm)
Weight	9 oz. (including battery). (250 g)

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

* For continuous operation below +20°F (−7°C), we suggest you use an alkaline or a nickel-cadmium battery.

CIRCUIT DESCRIPTION

Two identical integrated circuits (IC's) with associated components make up the tone oscillators in the encoder circuitry. The low tones are generated by IC101, the high tones by IC102. When one of the keyboard buttons is being pushed, each oscillator produces a tone.

Two or more precision resistors in a divider string are connected between pin 7 of either IC and B+. The R/C constant, determined by the value of capacitor C101 and the total resistance value between pin 2 of the IC, and B+ determine the frequency of the tone generated in the low tone oscillator. The high tone oscillator operates in the same manner.

The low tone generated in IC101 is filtered by resistor R116 and capacitor C111 and is then coupled to the input (pin 2) of the amplifier stage, IC103. Resistors R121 and R116 determine the voltage gain of the low tones.

The high tone generated in IC102 is filtered by resistor R117 and capacitor C111 and is also coupled to the input of IC103. Resistors R121 and R117 determine the voltage gain of the high tones.

Capacitor C108 provides DC isolation between the amplifier stage and the two oscillators. Resistor R118 and capacitor C107 provide a DC bias voltage to IC103.

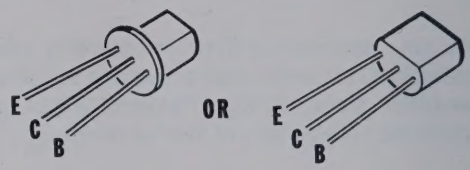
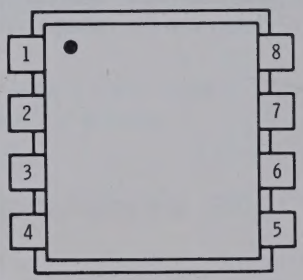
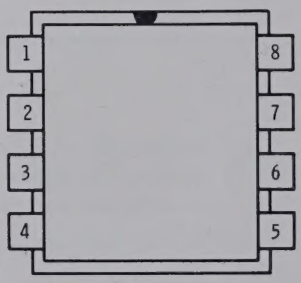
The two-tone signal is filtered in the amplifier stage, to provide a clean signal across level control R122. A portion of this signal is then applied to the transmitter modulator stage via the microphone input line.

When low tones are generated by IC101, the LED lamp will turn on, indicating that the low tone oscillator circuit is operating.

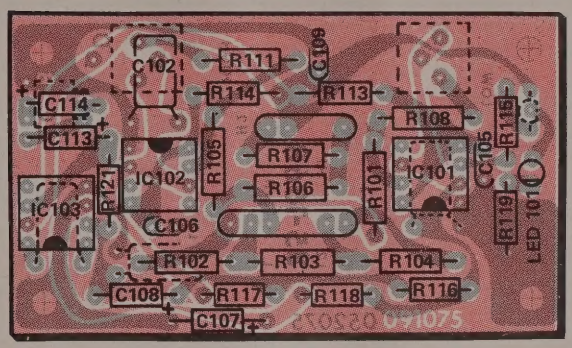
When the Micoder PTT switch is depressed, power is applied to the encoder circuitry and the microphone amplifier. At the same time, the transmitter circuits are enabled. Resistor R123 reduces the voltage applied to the microphone amplifier. Resistor R124 isolates the microphone output from the encoder output.

The capacitor-type microphone element has an audio frequency amplifier built into it.

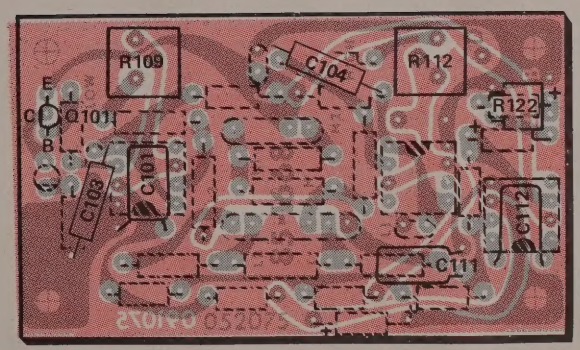
SEMICONDUCTOR IDENTIFICATION CHART

COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
LED101	412-79	TIL209	
Q101	417-201	X29A829	
IC101, IC102	442-53	NE555V	 (TOP VIEW) 1. GROUND 2. TRIGGER 3. OUTPUT 4. RESET 5. CONTROL VOLTAGE 6. THRESHOLD 7. DISCHARGE 8. V_{CC}
IC103	442-39	LM301A	 (TOP VIEW) 1. OFFSET NULL 2. INVERT INPUT 3. NON INVERT INPUT 4. GROUND 5. OFFSET NULL 6. OUTPUT 7. V_{CC} 8. FREQ. COMP.

CIRCUIT BOARD X-RAY VIEWS



**(Viewed from printed side.
Printed side foil shown in red.)**



**(Viewed from foil side.
Printed side foil shown in red.)**

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

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CITY _____

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TOTAL FOR PARTS			
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TOTAL AMOUNT OF ORDER			

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MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

October 1, 1976

IMPORTANT NOTICE

Please add the parts in the attached envelope to the parts for your Micoder.™ Then make the following changes in your Assembly Manual before you start to assemble your kit.

✓ Page 2 — Under "Resistors, 1/4-Watt."

✓ Add:	A2	1-76-12	1	4700 Ω (yellow-violet-red)	R120

✓ Page 3 — Under "Resistors, 1/4-Watt (cont'd)."

Change:	A2	1-15-12	2	330 kΩ (orange-orange-yellow)	R116, R118
To:	A2	1-15-12	1	330 kΩ (orange-orange-yellow)	R118
Add:	A2	1-16-12	1	180 kΩ (brown-gray-yellow	R116

✓ — Under "Capacitors."

Delete:	C2	25-209	1	.047 μF tantalum	C114

Page 7 — Change the fifth step in the left column to read:

(✓) R116: 180 kΩ (brown-gray-yellow). NOTE: Your circuit board is marked 330 k at this location.

— Change the second step in the right column to read:

( ) R120: 4700 Ω (yellow-violet-red). NOTE: Use the lower hole, indicated by the heavy outline. Disregard the circuit board marking at this location.

Page 10 — At the end of the right column, add:

(✓) Solder the control leads (R112 and R109) to the circuit board foil.

Schematic (fold-in) —

Change resistor R116 to 180 kΩ.

Change capacitor C114 to a 4700 Ω resistor, R120.

NOTE: You will have a 330 kΩ (orange-orange-yellow) resistor and a .047 μF tantalum capacitor left over after you finish the assembly of your Micoder. These components will not be used and can be discarded.

Thank you,

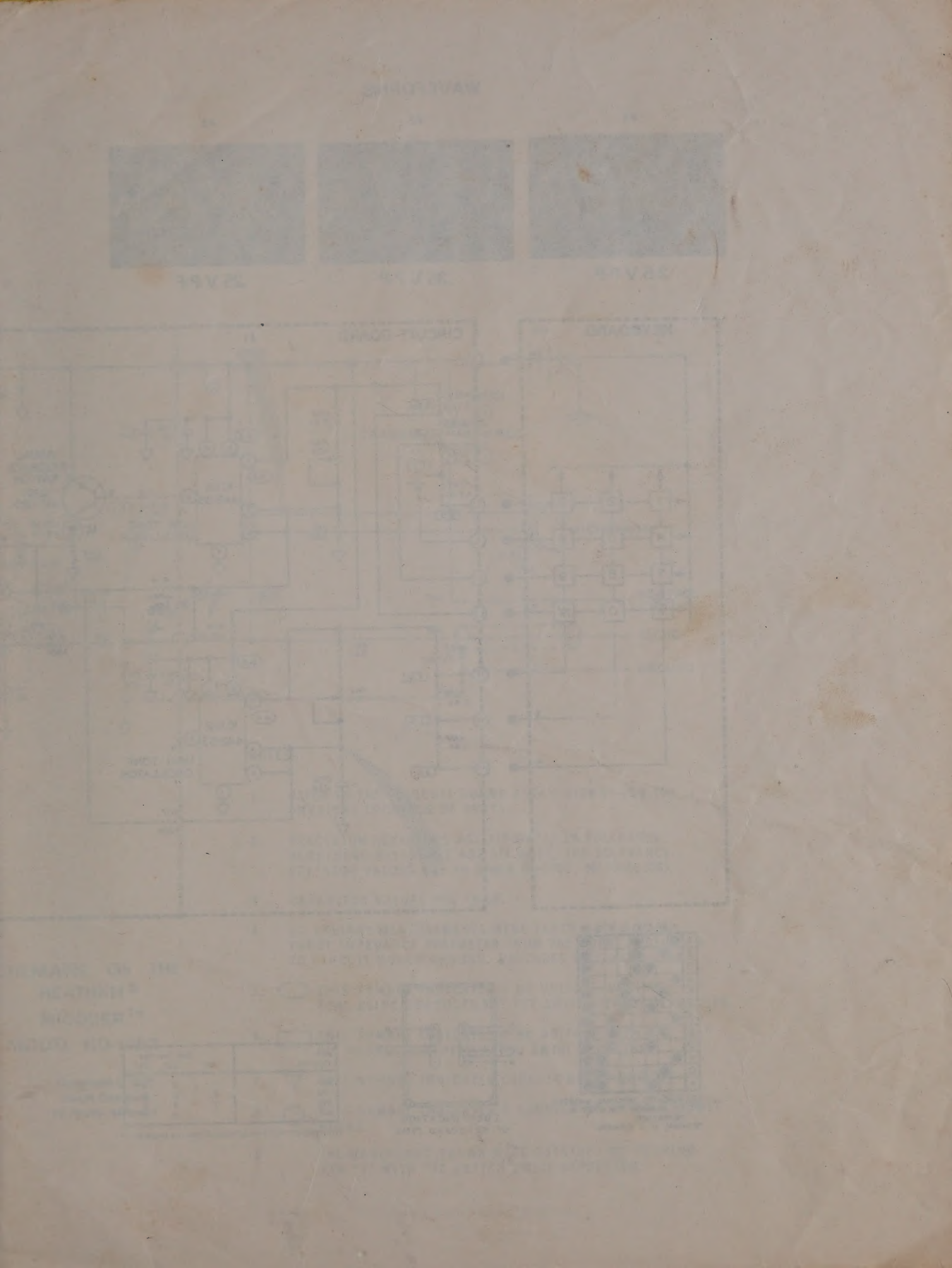
HEATH COMPANY

HD-1982/595-1888-01
591-2182

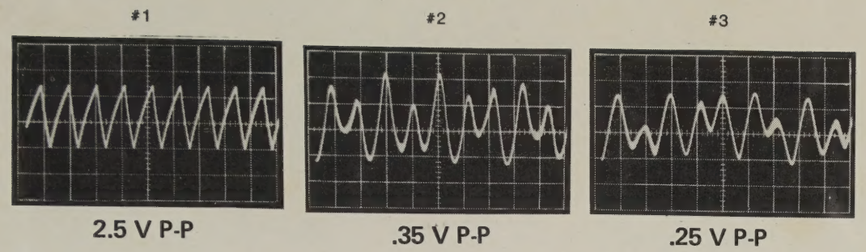
HEATH

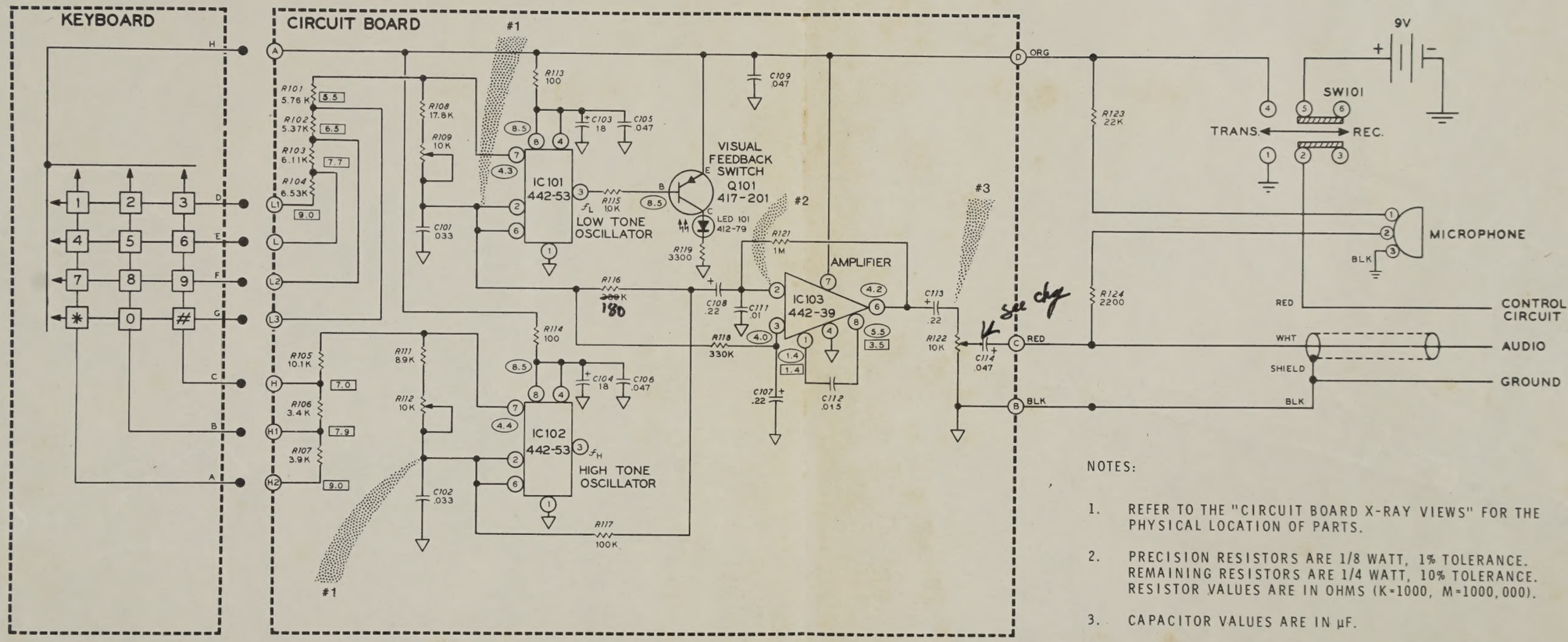
Schlumberger

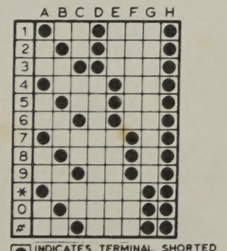
IMPORTANT NOTICE



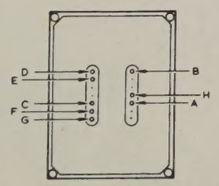
WAVEFORMS







INDICATES TERMINAL SHORTED TO COMMON WHEN KEY IS DEPRESSED
TERMINAL H IS COMMON



IDENTIFICATION OF KEYBOARD PINS

Low Tone (Hz)	High Tone (Hz) 1209	1336	1477
697	1	2	3
770	4	5	6
852	7	8	9
941	*	0	#

TWO-TONE OUTPUT FREQUENCIES FROM THE MICODER™

SCHEMATIC OF THE HEATHKIT® MICODER™ MODEL HD-1982

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Heath Company
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NOTES:

1. REFER TO THE "CIRCUIT BOARD X-RAY VIEWS" FOR THE PHYSICAL LOCATION OF PARTS.
2. PRECISION RESISTORS ARE 1/8 WATT, 1% TOLERANCE. REMAINING RESISTORS ARE 1/4 WATT, 10% TOLERANCE. RESISTOR VALUES ARE IN OHMS (K=1000, M=1000,000).
3. CAPACITOR VALUES ARE IN µF.
4. DC VOLTAGE MEASUREMENTS WERE TAKEN WITH A HIGH INPUT IMPEDANCE VOLTMETER FROM THE POINT INDICATED TO CIRCUIT BOARD GROUND. VOLTAGES MAY VARY ±10%.
5. ⬭ THIS SYMBOL INDICATES A DC VOLTAGE WITH NO TONE BEING PRODUCED, BUT PTT SWITCH SW101 DEPRESSED.
6. ▭ THIS SYMBOL INDICATES A DC VOLTAGE WITH KEY "1" PUSHED AND PTT SWITCH SW101 DEPRESSED.
7. ▽ THIS SYMBOL INDICATES CIRCUIT BOARD GROUND.
8. ○ THIS SYMBOL INDICATES A CONNECTION TO THE CIRCUIT BOARD.
9. THE WAVEFORMS SHOWN WERE OBTAINED BY PUSHING KEY "1" WITH PTT SWITCH SW101 DEPRESSED.

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

February 16, 1977

IMPORTANT NOTICE

Please make the following changes in your Manual before you start to assemble you kit.

Page 84 — Right column. Delete the last two steps, which read:

"( ) Prepare the cut end of each fuseholder assembly wire."

"( ) Install a 5-ampere, 3 AG fuse and reassemble the fuseholder assembly."

Page 84A — Turn this Notice over and place the newly designated Page 84A between Pages 84 and 85 in your Manual.

Thank you,

HEATH COMPANY

HW-2036/595-1939-02
591-2292

(✓) Remove the two 7" wires from the fuseholder housing halves. Set the two plastic pieces and the spring aside temporarily.

(✓) Cut two 1" pieces of heat-shrinkable sleeving.

( ) Push a 1" piece of sleeving onto one of the red fuseholder wires. Push it all the way down the wire and onto the brass ferrule as shown in Part A of Detail 5-11C.

(✓) With a suitable source of heat, shrink the sleeving onto the wire and brass ferrule.

(✓) Push this prepared wire thorugh one of the fuseholder halves and pull it all the way until the sleeving emerges from the wire hole. Set this fuseholder half aside temporarily.

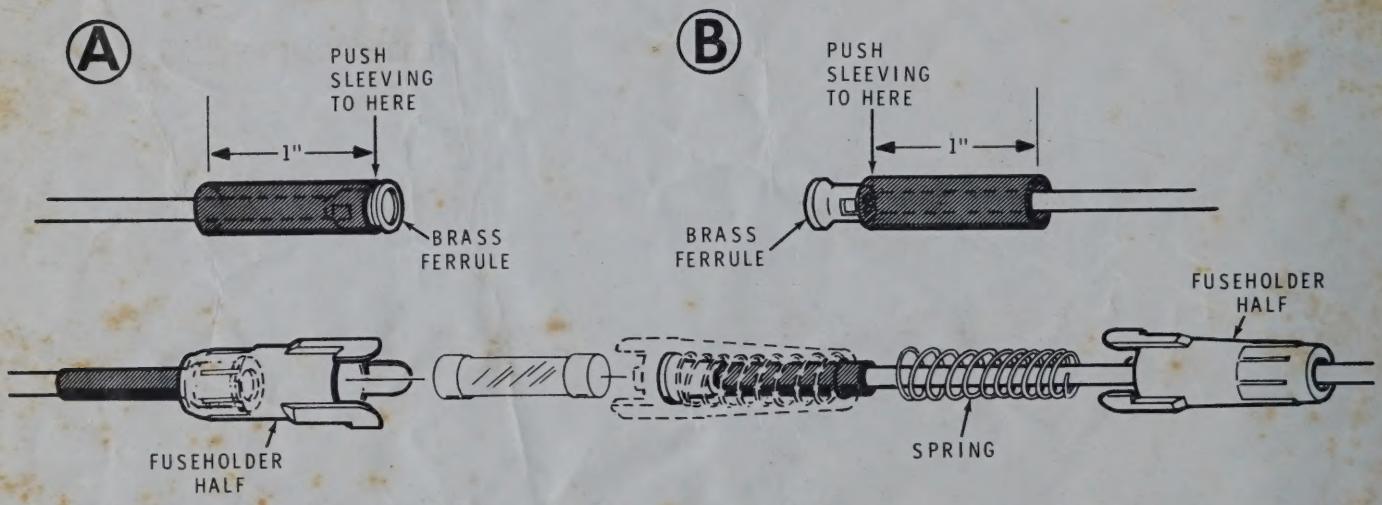
(✓) Refer to Part B of Detail 5-11C and place another 1" piece of heat-shrinkable sleeving onto the remaining 7" fuseholder wire. Slide the sleeving down until it just touches the brass ferrule.

(✓) Shrink this sleeving just a little; then push it against the brass ferrule again. Finish shrinking the sleeving onto the wire.

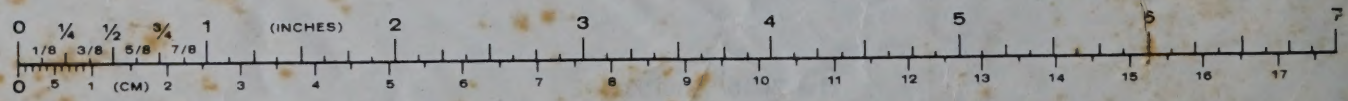
(✓) Place the fuseholder spring onto the end of the wire; then pull the wire through the remaining half of the fuseholder until the sleeving emerges from the wire hole.

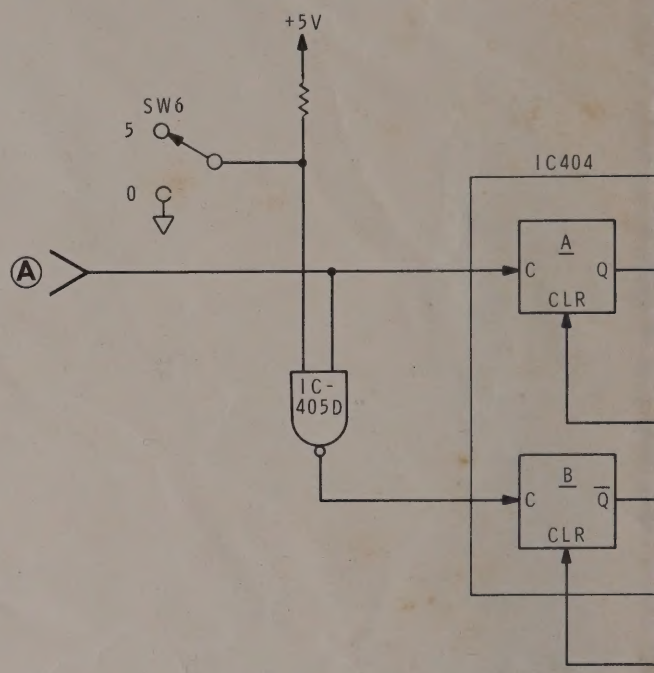
(✓) Prepare the cut end of each fuseholder assembly wire.

(✓) Install a 5-ampere, 3AG fuse and twist the two fuseholder halves together.

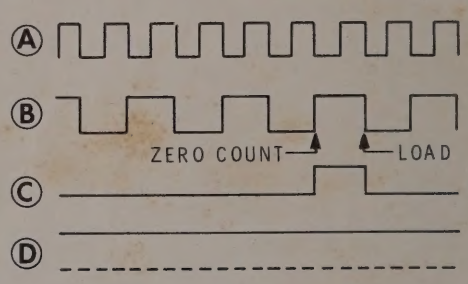


Detail 5-11C





SW6 AT 0KHZ



Figure

(✓) Remove the two 7" wires from the fuseholder housing halves. Set the two plastic pieces and the spring aside temporarily.

(✓) Cut two 1" pieces of heat-shrinkable sleeving.

( ) Push a 1" piece of sleeving onto one of the red fuseholder wires. Push it all the way down the wire and onto the brass ferrule as shown in Part A of Detail 5-11C.

(✓) With a suitable source of heat, shrink the sleeving onto the wire and brass ferrule.

(✓) Push this prepared wire thorugh one of the fuseholder halves and pull it all the way until the sleeving emerges from the wire hole. Set this fuseholder half aside temporarily.

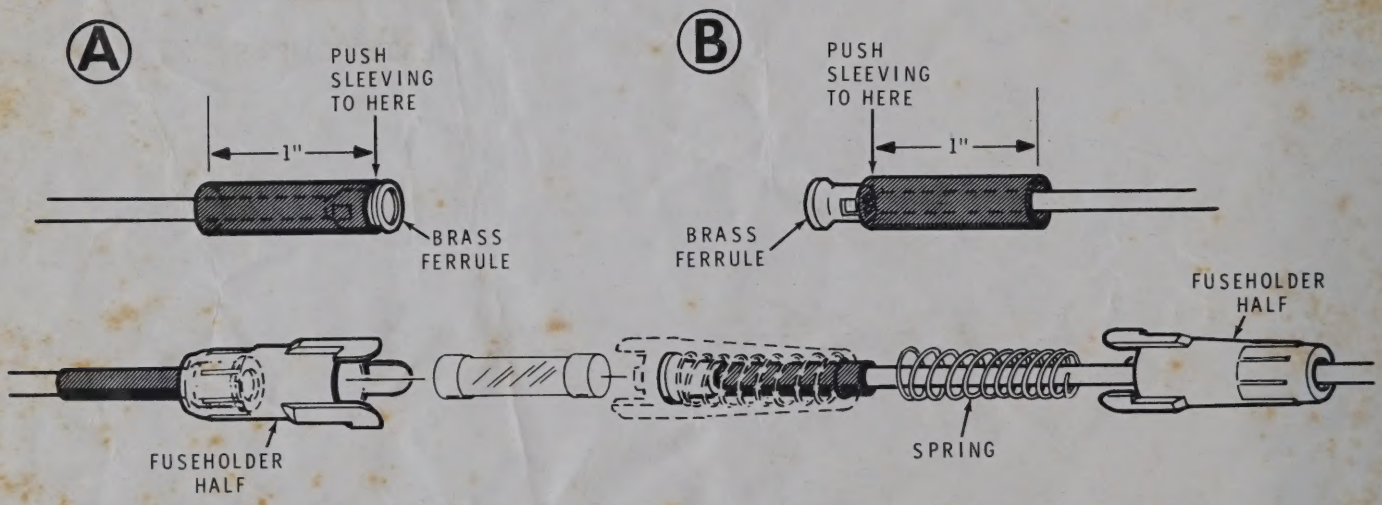
(✓) Refer to Part B of Detail 5-11C and place another 1" piece of heat-shrinkable sleeving onto the remaining 7" fuseholder wire. Slide the sleeving down until it just touches the brass ferrule.

(✓) Shrink this sleeving just a little; then push it against the brass ferrule again. Finish shrinking the sleeving onto the wire.

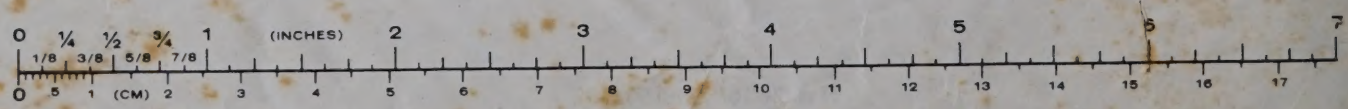
(✓) Place the fuseholder spring onto the end of the wire; then pull the wire through the remaining half of the fuseholder until the sleeving emerges from the wire hole.

(✓) Prepare the cut end of each fuseholder assembly wire.

(✓) Install a 5-ampere, 3AG fuse and twist the two fuseholder halves together.



Detail 5-11C



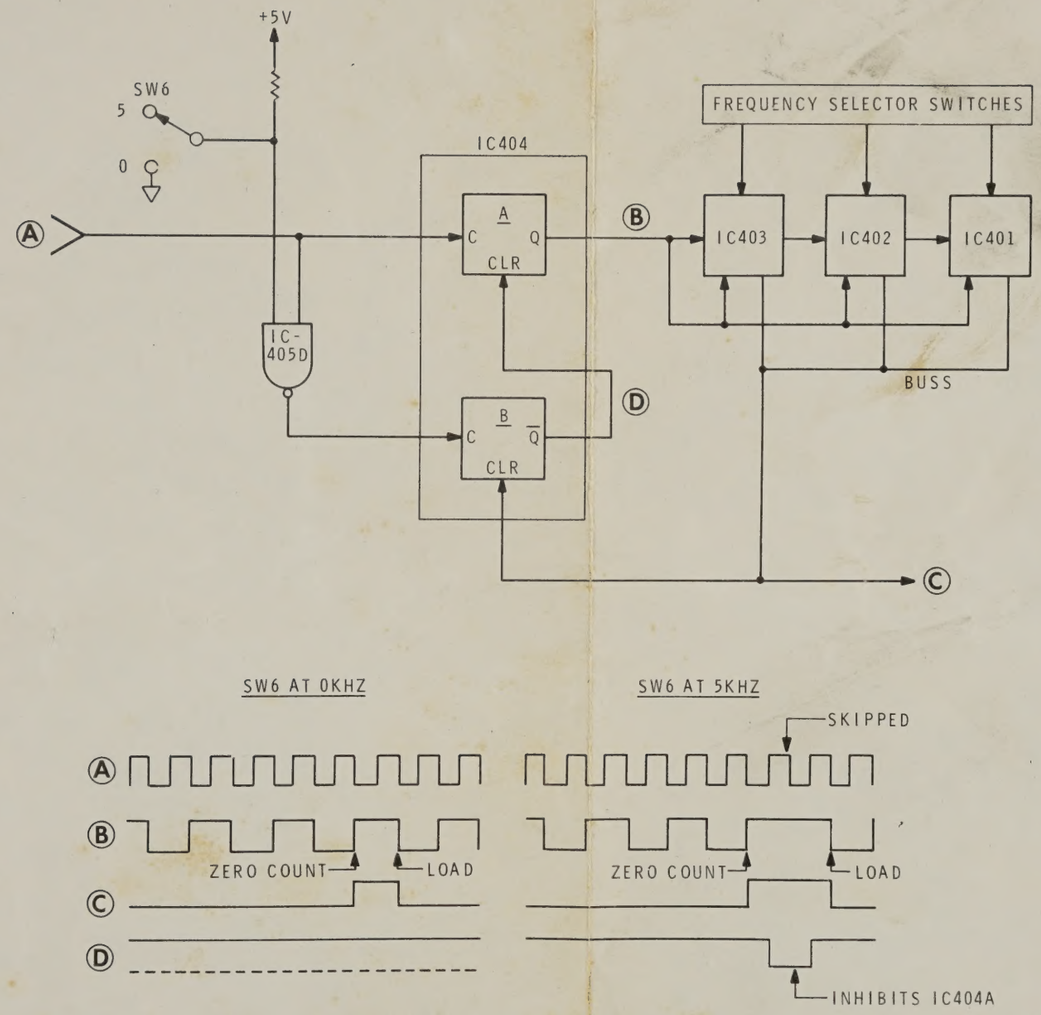
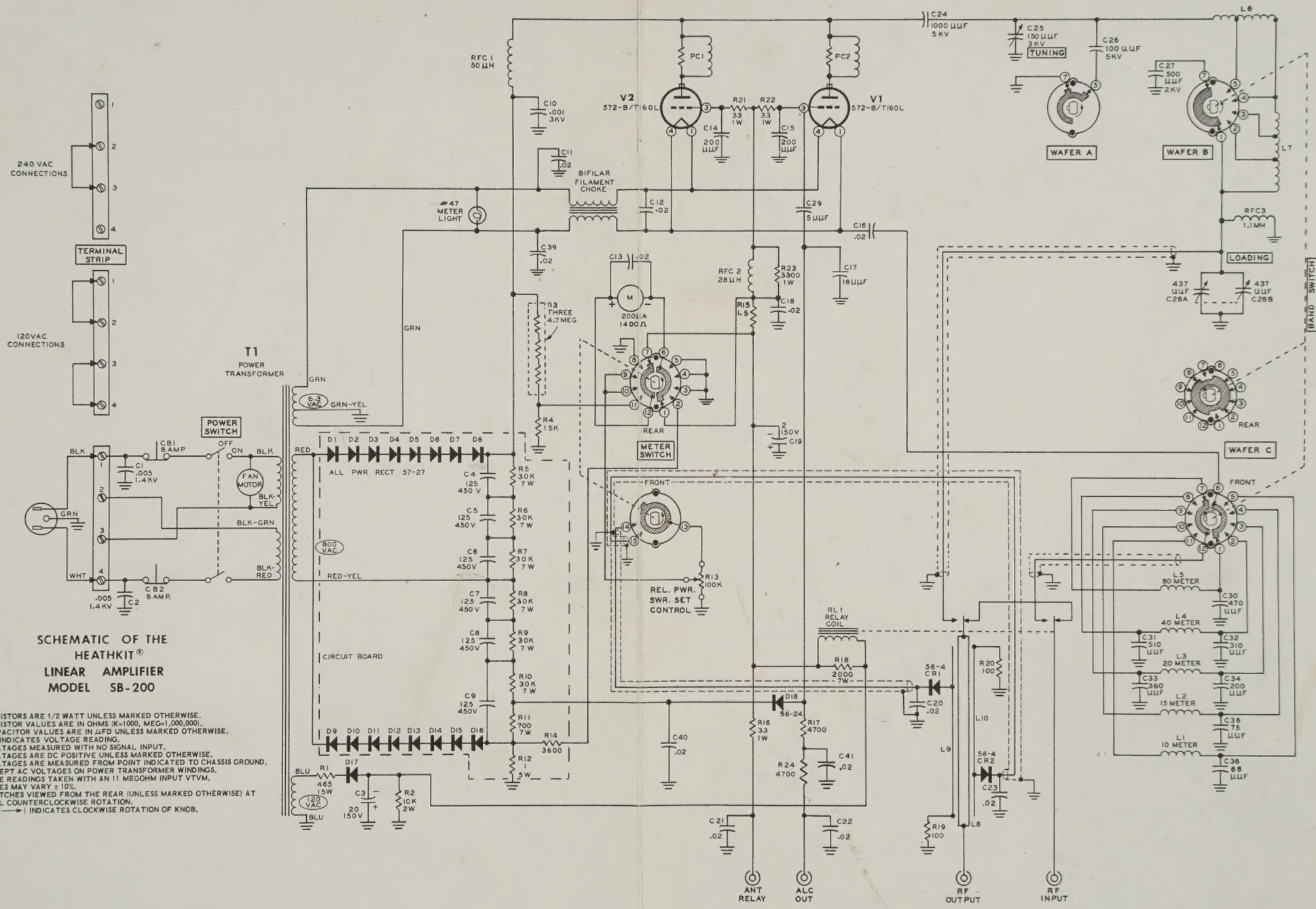

+5V
SW6
5
0
IC404
A
C
Q
CLR
IC-
405D
B
C
Q
CLR
Ⓐ
Ⓑ
Ⓒ
Ⓓ
FREQUENCY SELECTOR SWITCHES
IC403
IC402
IC401
BUSS
SW6 AT 0KHZ
SW6 AT 5KHZ
SKIPPED
ZERO COUNT
LOAD
ZERO COUNT
LOAD
INHIBITS IC404A

Figure 1



SCHEMATIC OF THE HEATHKIT® LINEAR AMPLIFIER MODEL SB-200

NOTES:
ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE.
ALL RESISTOR VALUES ARE IN OHMS (K=1000, MEG=1,000,000).
ALL CAPACITOR VALUES ARE IN µFD UNLESS MARKED OTHERWISE.
⬭ INDICATES VOLTAGE READING.
ALL VOLTAGES MEASURED WITH NO SIGNAL INPUT.
ALL VOLTAGES ARE DC POSITIVE UNLESS MARKED OTHERWISE.
ALL VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND, EXCEPT AC VOLTAGES ON POWER TRANSFORMER WINDINGS.
VOLTAGE READINGS TAKEN WITH AN 11 MEGOHM INPUT VTVM.
VOLTAGES MAY VARY ± 10%.
ALL SWITCHES VIEWED FROM THE REAR (UNLESS MARKED OTHERWISE) AT FULL COUNTERCLOCKWISE ROTATION.
ARROW (⟶) INDICATES CLOCKWISE ROTATION OF KNOB.

REPLACEMENT PARTS PRICE LIST

To order parts, use the Parts Order Form furnished with this kit. If Parts Order Form is not available, refer to "Replacement Parts" in the "Kit Builders Guide".

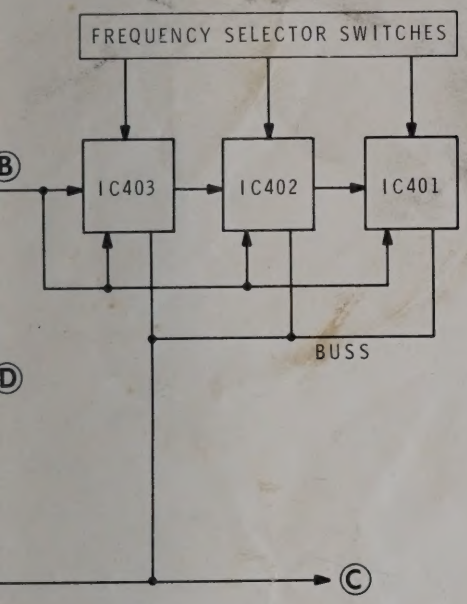
PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1/2 Watt		
1-140	.15	1.5 Ω
1-3	.10	100 Ω
1-16	.10	4700 Ω
1-21	.10	15 KΩ
2-121	.10	3600 Ω precision
1 Watt		
1-14-1	.10	33 Ω
1-3-1	.10	3300 Ω
1-38-1	.10	4.7 megohm
Other Resistors		
1-3-2	.20	10 KΩ 2 watt
3-25-5	.90	1 Ω 5 watt
3-12-7	.15	700 Ω 7 watt
3-14-7	.15	2000 Ω 7 watt
5-2-7	.30	30 KΩ 7 watt
3-2-17	.35	465 Ω 15 watt
CAPACITORS		
20-40	.20	470 μμf silver mica
20-123	.50	500 μμf 2 KV silver mica (.0005)
20-42	.20	510 μμf silver mica
20-76	.15	68 μμf mica
20-110	.15	75 μμf mica
20-108	.20	200 μμf mica
20-112	.25	310 μμf mica
20-131	.25	360 μμf mica
21-78	.10	5 μμf disc
21-60	.10	18 μμf disc
21-72	.20	.005 μfd 1.4 KV disc
21-90	.20	.001 μfd 3 KV disc
21-31	.10	.02 μfd disc
21-109	2.70	100 μμf 5 KV tubular ceramic
21-165	1.75	1000μμf 6 KV tubular ceramic
25-39	.60	2 μfd 150 V electrolytic
25-19	.55	20 μfd 150 V electrolytic
25-34	2.10	125 μfd 450 V electrolytic
26-96	9.80	150 μμf, 3 KV, variable
26-97	16.40	874.8 μμf variable, 2-section

PART No.	PRICE Each	DESCRIPTION
CONTROLS-SWITCHES		
10-12	.45	100 KΩ control
61-14	2.40	DPST rocker switch
63-351	4.35	3-wafer rotary switch
63-352	3.05	1-wafer rotary switch
65-15	1.80	8 ampere circuit breaker
69-5	5.00	DPDT 110 V AC relay
COILS-CHOKES-TRANSFORMERS		
40-98	.55	RF driver element
40-99	.10	RF pickup element
40-591	.55	80 meter input coil
40-592	.55	40 meter input coil
40-593	.55	20 meter input coil
40-727	.50	15 meter input coil
40-728	.50	10 meter input coil
40-596	1.40	10 and 15 meter final coil
40-597	4.00	20, 40, and 80 meter final coil
45-4	.40	1.1 mh RF choke
45-60	3.05	10 μh RF choke
45-18	.30	28 μh RF choke
45-61	.60	50 μh RF choke
45-53	.40	Parasitic RF choke
54-151	33.75	Power transformer
DIODES-TUBES		
56-26	.30	1N191 crystal diode
56-24	.60	1N458 silicon diode
57-27	.60	Silicon diode
411-198	17.95	572-B tube or T160-L
INSULATORS-GROMMETS-TERMINAL STRIPS-SOCKETS		
71-5	.45	Ceramic standoff insulator with 6-32 stud
73-4	.10	5/16" grommet
73-1	.10	3/8" grommet
73-3	.10	1/2" grommet
75-29	.60	Line cord strain relief
431-50	.10	1-lug terminal strip
431-16	.10	2-lug terminal strip
431-10	.10	3-lug terminal strip
431-11	.10	5-lug terminal strip
431-45	.10	6-lug terminal strip
431-13	.15	Screw type terminal strip
434-9	.30	4-lug tube socket
434-42	.10	Phono socket
436-5	.85	Coaxial socket
438-9	.75	Coaxial plug
438-12	.20	Coaxial plug insert
438-4	.10	Phono plug

PART No.	PRICE Each	DESCRIPTION
WIRE-CABLE-SLEEVING		
89-22	1.40	Line cord
134-107	2.25	Cable assembly
340-1	.05/ft	Bare wire
344-52	.05/ft	Red solid hookup wire
344-54	.05/ft	Yellow solid hookup wire
344-55	.05/ft	Green solid hookup wire
344-58	.05/ft	Gray solid hookup wire
344-13	.05/ft	Large blue hookup wire
343-2	.10/ft	Large shielded cable
343-3	.05/ft	Small shielded cable
346-4	.05/ft	Small sleeving
346-3	.10/ft	Large sleeving
HARDWARE		
Screws		
250-213	.05	4-40 x 5/16"
250-28	.05	6-32 x 1/4" setscrew
250-8	.05	#6 x 3/8" sheet metal screw
250-138	.05	6-32 x 3/16" screw
250-56	.05	6-32 x 1/4"
250-89	.05	6-32 x 3/8"
250-218	.05	6-32 x 3/8" phillips head
250-32	.05	6-32 x 3/8" flat head
250-26	.05	6-32 x 5/8"
250-29	.05	6-32 x 3/4"
250-40	.05	6-32 x 1-1/2"
250-260	.05	8-32 x 1/4"
250-43	.05	8-32 x 1/4" setscrew
250-141	.05	10-24 x 1/2"
250-126	.05	10-32 x 1/2"
250-67	.05	10-24 x 1-1/8" phillips head
251-1	.05	6-32 spade bolt
Nuts		
252-15	.05	4-40
252-3	.05	6-32
252-30	.05	10-24
252-31	.10	10-24 wingnut
252-7	.05	Control
WASHERS		
253-27	.05	5/16" flat steel
253-8	.05	7/16" flat brass
253-60	.05	3/8" flat steel
253-1	.05	3/8" fiber flat
253-3	.05	1/2" fiber flat
253-7	.05	1/2" fiber shoulder
253-10	.05	Flat control
253-19	.05	3/4" flat steel
254-9	.05	#4 lockwasher
254-1	.05	#6 lockwasher
254-3	.05	#10 lockwasher
254-4	.05	Control lockwasher

PART No.	PRICE Each	DESCRIPTION
MISCELLANEOUS		
255-2	.05	3/16" spacer
255-42	.30	3/4" phenolic spacer
255-12	.10	Plastic spacer
255-59	.15	Tapered spacer
259-1	.05	#6 solder lug
259-5	.05	#10 solder lug
259-10	.05	Control solder lug
260-34	.25	Anode clip
435-1	.05	Socket ring
METAL PARTS		
40-100	.20	Coaxial cavity
90-341	20.80	Cabinet
200-403-1	6.60	Chassis
203-384-1	1.55	Front panel
205-492	.10	Capacitor mounting bracket
204-560	.25	Angle bracket
204-611	.15	Circuit breaker mounting bracket
206-254	1.90	RF shield
206-255	.50	Power supply shield
205-438	1.75	Top plate
MISCELLANEOUS		
85-88-2	3.20	Circuit board
261-9	.05	Rubber foot
266-21	.60	Fan blade
390-147	.10	DANGER label
391-31	.15	Nameplate
407-103	11.40	Meter
420-3	5.00	Motor
432-27	.40	3-prong AC adapter
462-191	.70	Small knob
462-210	1.05	Large knob
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from an authorized Service Center or Heathkit Electronic Center to cover local sales tax, postage and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.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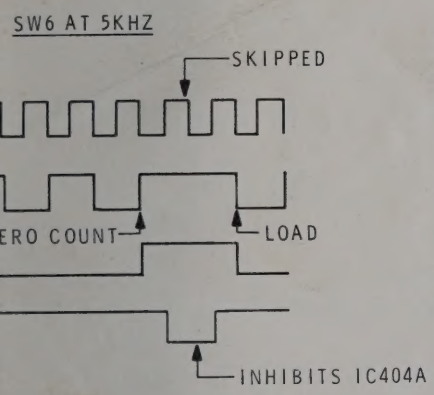
SW6 AT 5KHZ
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CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

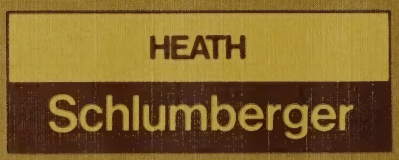
If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.